YOUR

COMMODORE

OCTOBER 1988

£1.20

IRREGULAR ADD-ONS
a round-up of unusual accessories

Games Reviewed:
- Dark Side
- Football Manager II
- The Games—Winter Edition
- Netherworld
- Fernandex Must Die

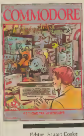
Alarm—programmer's time out

UNBEATABLE PROGRAMS:

JOYSTICK CURSOR ☐ FILE EXTENSION ☐ HI-RES FILL ☐ CODE RELOCATION

The price of coming fi
at the Olympics
COMMODORE
149.99

OLYMPIC



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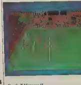

Football Manager II

FEATURES

PROGRAMS

VOLUME 5
NUMBER 1

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GROUP

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AVAILABLE
7th OCTOBER
1988

ISSN
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Epson add special effects to the FX

FX Parking Permit

The Epson FX850 and FX1050 printers have been upgraded to incorporate a paper parking facility

The new units, which retail at £459 and £599 respectively, can now be used with a minimum of fuss when continuous stationery is swapped for sheet feeding Instead of unlacing the tractor feed manually, new owners can just flick a lever and press a switch The actions automatically withdraw the paper out of the printer's paper path but the tractor sprocket remains engaged. This means that after the sheet feeding has been completed, tractor feed can be resumed without the need to reface the paper by hand

The machines also feature three internal character fonts, 246cps draft and 54cps NLQ speeds, also all done with less than 55dBA of noise

Touchline. *Epson (UK) 388 High Road Wembley Middlesex H 49 6UH* **Tel** *01-902 8892*

Ingrid star of Level 9's Gnome II

Level Gnome

At Level 9, Gnome is where the heart is and to prove it Ingrid's Back The diminutive star of Gnome Ranger returns to battle against Jasper Quickbuck in Gnome II

Quickbuck is planning a Yuppie Homes development in a quiet corner of the gnome counties Only one thing stands between him and his dreams of suburbia — Ingrid Bottomlow and her accident prone ways

Also nearing completion is Pete Austin's megaproject Lancelot. After months of research, Austin has combined hi-tech programming with Mallory's Morte D'Arthur to produce a three part adventure which follows Lancelot's knighting, his fall from grace with Guinever and the search for the Holy Grail

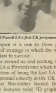
Touchline *Level 9, 5 Mendip Road Crown Wood Bracknell Berkshire RG12 3XG* **Tel** *0344 487597*

Arts Trek

Electronic Arts are releasing the 'Wargame of the Century' and its simply called Empire The objective is to search out alien lifeforms and blast them to bits

This may sound like a corruption of Star Trek so far but there's more The player takes the roll of Captain William P Brown of the UGAS Britannia, an enterprising chap who wishes to seek out the evil Krellans who cling on to large tracts of real estate known as the Krellan Empire

William P Brown has to boldly go into the heartlands of the Krellans completely phase them into submission and escape scot free as he checks off another conquered world leaving bare bones and shouting a battle cry of 'Ooh, hurrah!' at the death of the Krellans Then, realising that he spoke too soon, he heads off into uncharted space to do battle once more



Michael Powell EA's first UK programmer

Empire is a one to three player game of strategy in which the winner is the last to survive

The second up and coming release from EA is Powerdrome which has the distinction of being the first EA game to be penned entirely in the UK

This November launch for the Amiga features solid 3D graphics of a jet racer championship of the future The Powerdrome series consists of six races, each at different tracks which feature differing weather conditions

A special feature is included in the two player game which requires two Amigas to be linked together Once the union is made the two combatants can race against each other after tuning up and getting a suspensor grid position through speed trials at the start of the race

Touchline *Electronic Arts 11 49 Station Road Langley Berkshire SL3 8YN Tel 0753 49442*

Gung Ho Prose

Glasnost is a word which doesn't appear to feature in Wild Bill Stealey's vocabulary down at Microprose HQ. Once more it's time to loose the dogs of war on the Commie threat as Red Storm Rising makes a transition from book to game.

Tom Clancy's best seller concerns events in a future world war between the Russians and Americans in which a lone nuclear submarine has the task of wiping out the USSR's underwater fleet.

Microprose's leading programmer and designer, Steve Meier, has been given the task of converting words into bytes. Meier promises that the new simulation will be far more advanced than Microprose's highly acclaimed Silent Service.

In the meantime, the PC Show's centrepiece was provided by Microprose in the form of a highly advanced simulation machine. The Super X Prokon flight simulator combines sensitive mechanical control with a wide angle computer generated visual display to give its 14 passengers the sensation that they're really flying.

Microprose's PC Show stopping Super X flight simulator

Touchline *Microprose 2 Market Place Tetbury Gloucester GL8 8DA*
Tel *0666 54326*

Vive la micro

The French are preparing for their second Festival de la Micro show on 14-16th of October at Espace Champerret, Paris. This is only the second year that the show has been held but it is rapidly establishing itself as the Gallic equivalent to the PC Show.

The festival is hosted by Neo Media press group and it was developed through necessity rather than by design. Neo Media organised an Amstrad show in 1986. It proved so successful that Amstrad France decided to run the show themselves by registering the name Amstrad Expo and forbidding Neo Media from using the Amstrad name.

Jean Kaminsky, Neo Media's managing director and show organiser, was not deterred so easily and in October last year the Festival de la Micro attracted over 20,000 visitors. Apple, Atari, Amstrad, Commodore and Sega all took stands at the show and they will also be there again this year.

The only question that remains is whether Amstrad will be the biggest draw again this year or will Commodore or Atari pull the larger share of the crowd?

Touchline *Festival de la Micro Espace Champerret Porte de Champerret Paris*
Organiser *Neo Media 5-7 Rue de l'Amiral Courbet 94160 Sainte Mande*

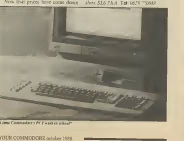
PC Plod

Commodore are to be commended for sticking with their PC compatibles and at last persistance may be paying off. With their prices at an all time low, the company is now promoting its discount schemes for educational establishments.

Under the scheme PC1s retailing at £315 (mono) and £430 (colour) are being supplied for £299 and £369 respectively. At the top end of the range the savings are even greater with PC60 80HD Enhanced Colour Display 80386 clone costing £4299, a saving of £1160 on the normal RRP.

Now that prices have come down so far it could be time for schools to re-examine their microcomputer policies with a thought to using the industry standard PC instead of the charming but remote BBC Micro. The fact that the PC is used in almost every computerised establishment would give the computer student a distinct advantage in gaining employment when cast from the academic world into that of commerce.

Touchline *Commodore Business Machines (UK) Ltd The Switchback Gardner Road Maidenhead, Berkshire SL6 7XA* **Tel** *0628 770088*



Is it time Commodore's PC 1 went to school?

COMMUNICATIONS CORNER

Our roving reporter David Janda is back with more news and views in the world of comms

One major problem associated with calling bulletin boards is the cost of the call Not only that but many BB numbers published in magazines and on BB's do not state the location of the BB itself

A new facility available to MicroLink subscribers can now solve that problem Called STD, users either enter the name of a town city or a dialing code and the exclusive of the two will be displayed

As an example, entering '0424' will result in 'Hastings' being displayed Alternatively, entering Hastings will result in 0424' being displayed

At the time of writing the service does not incorporate area codes within a city but this will be introduced at a later date International dialing codes and associated country names will also be introduced

Prestel Micronet subscribers have a similar facility within the British Telecom database on Prestel Located at page 383614 is an area code locator This is used by entering the first three digits of the area code This will display a list of the areas covered by that exchange Major cities are covered so it is possible to get a breakdown of area codes within a major conurbation such as London

The Price of Microlink

Shortly after the new Tariff changes for Prestel Micronet were announced, MicroLink issued a statement that it would not be increasing its prices

However, it appears that even though MicroLink charges have not gone up in the last three and a half years, the operational costs have In a letter to all subscribers, Derek Meakin, MD for Database Publications which operates MicroLink said that the company could no longer subsidise its customers As a result the minimum monthly standing charge of £3 has been increased to £5 This brings the standing charge in line with the rest of Telecom Gold

In the letter Meakin also promised a number of enhancements to MicroLink including the addition of yet more gateways both national and international

Your Commodore notes that MicroLink still represents excellent value for money Not only does it offer a comprehensive range of facilities beyond what Telecom Gold provides, but MicroLink subscribers do *not* have to pay any block data transfer charges The data transfer charge was introduced in August 1987 and is a charge for every 512 character-block of data sent received to from Telecom Gold

The Magazine Grows!

Xtra! The magazine suppliment area on Micronet has a new section called Voltage

The area will cater for those interested in Hi-fi and consumer electronics by providing the readers with news, reviews and features on the latest gadgets for the Hi-tech yuppies among you

Voltage will be updated on a regular basis and reading it incurs no extra charge for Micronet subscribers Prestel only subscribers can read Voltage, but are time charged at different rates depending on what time of day the section is read

The Deamon Dies!

Dataphone Ltd of Peterborough is no more The company manufactured and sold modems including the Demon II and the Designer

According to former MD Martin Payne the company was under financial stress for some time It is understood that extensive delays in obtaining BABT approval for the Demon II and Designer modems contributed to the companies problems

New backing in the form of a company called Modem Marketing has been sought and the new company will be selling Dataphone products

Micronet on the Move

Telemap Group Ltd, who s promary product is the Micronet database on Prestel is to move its HQ from London to Apsley near Hemel Hempstead The move which will be made early 1989 will result in Telemap sharing office space with Dialcom UK Dialcom is part of British Telecom and incorporates Prestel, Telecom Gold, and a host of other value added services

According to Micronet the move will result in better communications between The Net and Prestel

However, *Your Commodore* has received information from several reliable sources who suggest that British Telecom (who currently have a 40% share in Telemap Group Ltd) will buy out the two other Telemap share holders These are EMAP and Bell Canada

This would be a logical move on BT's part as it would mean that Micronet (which is the largest IP on Prestel) would be under its control

Although this information has not been confirmed by the top management at Telemap (who were not available for comment) this writer believes it to be the case

More Amiga Coverage

Editorial coverage for the Amiga on Micronet has been rather thin until now

Before coverage was supplied by the contributors of the 16 32 area This has all changed as the Solely CBM area provides information for Amiga owners as does the ST Amiga area which now has a full time member of Micronet s staff writing for it

At present, there is no seperate microbase on Micronet for Amiga owners, but this may change if the number of Amiga owners subscribing to Micronet increases

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Gateways from Microlink
(c) Database Publications

1     Mnematics
2     Echo
3     AIMS Database
4     Infocheck
5     Jordan Watch
6     Official Airways Guide
7     World Reporter
8    FinTech   Financial Times Pubs
9     Petroleum Monitor
10    Lotus
11    Kompass
12    BIS Infomat Newsfile
13    Wall Street Journal
14    Grants to UK Industry
15    Marketing Week


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[illegible] Datel still has [illegible] many areas, its success [illegible] le of the potential [illegible] ng for third party [illegible] hat are prepared to [illegible] es. Without these [illegible] C64 and C128 would [illegible] limited machines and [illegible] y their current success [illegible] piling this article has [illegible] that whatever the task [illegible] on with your C64 [illegible] is likely to be a piece of [illegible] and software available [illegible] that will make it a whole [illegible]

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[illegible] ds are an [illegible] nding your [illegible] add to or [illegible] hardware [illegible] ic knowledge [illegible] competent at [illegible] best out of them, [illegible] that simply [illegible] port so even [illegible] novice can [illegible]

Turbo ROM II; Datel Electronics £14.99

This chip replaces the C64s ROM with a turbo version capable of loading and saving programs five or six times faster than normal, and adds a ten second disk format routine and programmed function keys that provides functions such as load and directory and the touch of a key.

4 Wa[illegible] Kernel Board; Datel Electronics £12.99

This board slots in and replaces the kernal and provides an adaptor that can take 16K or 32K replacement ROMs and a switch so you can swap between the systems.

256K Superom Expander; Datel Electronics £29.99

dig your
# of Commodore Comm

P[illegible] c[illegible] eight [illegible] 32K [illegible] supplied [illegible] operating syste[illegible] of the eight EPRO[illegible] in a program

An EPROM gene[illegible] convert your own BAS[illegible] code programs and tu[illegible] autostart EPROMs

In effect the Superom expander provides a neat alternative to hordes of cartridges protruding from your C64 as 2764 27128 and 27256 EPROMs can be switched in and out as required giving you a suite of instant [illegible] accessed programs

Eprommer 64/Datel Electronics [illegible]39 99

The Eprommer 64 is the ideal companion board for the Superom Expander as it can be used to program 2[illegible] 64 27128 and 27256 chips

Menu driven programs allow you to program read verify and copy EPROMs simply so that they're ready for use in the Superom Expander

The Drive Box F S S L/£19 95

[illegible] Drive Box once soldered in will allow you to alter the drive number [illegible] of your 1541 1571 1570 or 128D disk drive and also write to the backside of a disk without cutting [illegible] the disk as it bypasses the [illegible] sensor

[illegible] F S S L £99 95

[illegible] plug in memory expansion board [illegible] the C64 that will add 256K to your [illegible] four 64K banks Supplied [illegible] power supply the 1764 [illegible] drain your C64 and will give you the extra memory needed in so many development projects

[illegible] F S S L £149 95

[illegible] available in this the C128 [illegible]

[illegible]

[illegible] are [illegible] other [illegible] cann[illegible] to match [illegible] colour [illegible] graphics [illegible] packages help you to [illegible] of these facilities [illegible] combination of hardw[illegible] software

Blazing Paddles/Datel Electro[illegible] £24.99.

A combined lightpen and graphics package system that promises to help you get the most out of your Commodore's graphics potential

The fibre optical lightpen plugs into the joystick port and is ideal for creating computer art as you can simply point to the part of the screen you want to work on. Add to that a software package that includes windows and icons for ease of use and features such as rubber banding, zoom modes a range of brushes the ability to cut and paste windows load and save shapes windows and screens and a colour mix over 200 hues and the result is a must for computer artists

Stop Press AMS/£79 95

Stop Press is one of the better C64 Desktop Publishing packages mainly due to the inclusion of the excellent AMX mouse

By moving the mouse and pressing one of its three buttons you can select from the programs pull down menus and create graphics and page styles in which you can paint on text created by a separate word processor In a recent survey of Commodore Desk Top publishers in the [illegible]ast *Your Commodore* Stop Press scored well It's success partly due to the easy to use software and partly to the AMX mouse that would top any mouse

[illegible] Together [illegible] ca[illegible]

BASIC [illegible] L £34 95

This is an [illegible]ible package for [illegible] C128 which together with F S.S.L. 64K Video RAM upgrade kit (£19 95) unleashes unimagined graphics power [illegible] can even rival the 16 bit machines

BASIC 8 adds over 50 commands [illegible] 28 Basic that allows you to draw a circle, box or 3D solid shape with a single command and includes commands to control windows create fonts, and select patterns and brushes

The result of your programming can be displayed in 80 column mode and in mono a resolution of 640 x 200 and 640 x 192 in 16 colour mode

Sound

[illegible] sound can be one of its most [illegible] features but few C64 users [illegible] to make the most of their [illegible]'s features Although there are a number of excellent music packages on the market somebody serious about computer music should check out the sounds of science created by these samplers, midi interfaces and electronic drum systems

Digital Sound Sampler/Datel Electronics/£49 95

Sound samplers can be great fun to use as you can record or sample any sound or noise and record it in memory Once it's there you can speed it up or slow it down play it back forwards or backwards and add echo reverb or ring modulation to create an amazing range of results that can be saved for later use

The Datel Digital Sound Sampler comes complete with a microphone and allows you to store and edit up to eight samples at any one time making it a powerful sound editing [illegible] anythin[illegible] a Dalek), t[illegible] sampled sounds of today's [illegible] r to create sound effects for [illegible] d radio

Com drum/ Datel Electronics/ £29 99

The Com-drum plugs into the cartridge port of your C64 and turns it into a digital drum machine

Through a menu driven editor you can create drum rhythms in real or step time and store up to eight drum sounds in memory and save them to tape or disk and then play them back through your hi-fi

A separate Com drum editor (£4 99) provides the Com-drummer with a disk full of 24 drum sounds that you can combine and edit to provide your own customised drum kit

MIDI 64/ Datel Electronics/ £29 99

MIDI is one of the buzzwords of the 80s and in this case stands for Musical Instrument Digital Interface that can transmit notes and how they are played (duration pitch etc) to a storage device or an instrument

For a basic MIDI system you need a keyboard, synthesiser, MIDI interface and computer Casio is probably your best source of keyboards and synthesisers, your C64 will prove to be an adequate computer and this a suitable interface between the two

[illegible]

[illegible] Commodore family of computers [illegible] one of the few that uses cartridges [illegible] expand and improve the original system The cartridge has an obvious advantage over disk or solder in ROM alternatives as they simply plug into the cartridge port and are instantly ready for use

Unfortunately the good name of cartridges has been slurred by people who still insist on driving up the price of software by copying programs for friends The cartridge companies have also fallen into this trap and base their advertising on how quick they can backup the latest releases

However now the companies are fighting back by maintaining that their [illegible] ools and [illegible] has the [illegible] or create a di[illegible] game as long as it is f[illegible] use Piracy simply pushes up [illegible] of programs

Action Replay IV Professional/ Datel Electronics/ £34.99

This is the updated version of possibly the best known cartridge and adds to the features of the original compactor backup, turbo loading sprite killing, printer dumping original by adding an onboard custom chip that includes an extended monitor that can freeze any program allowing the serious programmer to disassemble, compare fill, transfer hunt relocate and jump to any part of the code and the restart the program from the place you froze it

This can provide an educational tool for programmers who want to find out how their mentors created a certain effect

Final Cartridge III/ Datel Electronics/ £39 99

The latest version of the Final cartridge gives your C64 or C128 user a friendly front end as you control everything through windows and pull down menus

You can turn your joystick into an auto fire stick kill and disable sprite collisions freezes games to create screen dumps, includes a sprite and character editor and a programmer s toolkit incorporating commands such as Auto Renumber Delete Trace Append and Dump Add to that a calculator, real time clock notepad and turbo loader and you have a force to be reckoned with

Expert Cartridge/ Trilogic/ £29 99

The Expert differs from the other commercial cartridges since it contains RAM and not ROM chips Although this means you must load in the operating system from disk every time you use it, you can easily and cheaply upgrade the system by changing the disk which costs about £3 and not £30 which would be the cost of a new cartridge

Smart Cart/ Datel Electronics/

The Smart Cart is a battery p 32K RAM cartridge that acts ROM cartridge Although mo technical programmers can tak advantage of its I O slots, most users will be more than happy with the wa they can load their programs in memory flick a switch and then f the next five years (until the batt runs out) reload their program in a few seconds

An 8K version is also available half the price which makes the 32 version a better buy as well as be more useful

RAM Disk/ Datel Electronics/ £9

RAM disk turns your Smart Cart a 32K RAM disk capable of ins storing and retrieving files programs Through simple comm such as load, save, directory an scratch you can access this storage area as if it was a disk drive with the only difference being that the progra load and save instantly

3 Slot Motherboard/ Datel Ele tronics/ £16 99

This simple device will save the and tear on your cartridge port as i contains slots for up to three cartridges that can be switched in and out as required So if you've finished using the Final Cartridge you could swit to the Smart Cart Action Replay IV.

64 Doctor/ Trilogic/ £18 99

Here s a cartridge with a difference as the 64 Doctor is a diagnosis cartridge which examines your C64 and report back with any problems it finds all it performs tests on the keybo serial port cartridge port kernal ROM video chip and video banks, NMI and IRQ interrupts casse data, joystick ports user port BASI ROM, CIA chips sound chip, c key press and even tests out y joystick

This cartridge was developed b Trilogic as a result of its own wo in repairing micros and is designed t produce an accurate diagnosis whic will cut down the time and cost repairs

Trilogic also produces the Drive Doctor (£14 99) and Datasette Doctor (£8 99) to help you resolve tape and disk loading problems

Robotics

Robotics is a growing area of interest enjoyed by more enthusiasts every year Driven on by images of robots in science fiction films they strive to control the outside world from their keyboards The C64 can be used to experiment in this area with these three Datel packages They're still light years away from C3PO or R2D2 but it's a step in the right direction

Robotarm/Datel Electronics/£49 95

This robotarm has five axis of movement which can be controlled by two joysticks or via the Robotarm interface (Datel £24 99) to your C64 through which you can train or program it to create movement sequences

Four different attachments can expand its use as you can give your Robotarm fingers a shovel scoop, jaws or a magnetic attachment

Robotek 64/Datel Electronics/£39 99

Robotek 64 is a combined hardware and software package that allows your C64 to talk to the outside world Four output channels, four input channels, analogue input with full 8 bit conversion and voice input will allow you to experiment with controlling robots and models

Extras

In any article of this type you quickly run into gizmos that refuse to fall into any predefined categories and they usually end up getting lumped together at the end This article is no exception so here is a collection of gizmos including a natty little joystick, a teletext adaptor and two add-ons for those Commodore users that are upgrading to the Amiga.

Icontroller/Suncom (Microprose)/£11 95

The Icontroller is a tiny joystick (little more than an inch high) that sticks on top of the C64 or C128 and plugs into one of the joystick ports but through a second 9 pin adaptor leaves the port free

This mini stick is ideal for application programs such as GEOS or graphics packages but not for what the instructions describe as "the emotional movement involved in playing certain games"

Commodore 1581 Disk Drive/F S S L/£184 95

A new disk drive for the C64 and C128 that offers 1 megabyte of memory (800K formatted capacity) 3160 blocks and an impressive 8000 characters per second loading rate

1571 FIX ROM/F S S L/£24 95

Developed by Commodore Inc USA this plug in ROM solves most of the many problems faced by 1571 owners whether it be Device not Present errors or problems when using Superbase

Teletext Adaptor/Microtext/£79 95

Teletext pages such as those found on BBC's Ceefax and ITV's Oracle service provide a wealth of information ranging from football results to recipes to weather reports to latest currency and stock prices Now, with the Microtext Teletext adaptor you can call up the pages on your C64 screen and save the pages to tape or disk

You can also print them out for future reference and write your own programs that can read the information from the screen buffer and use it in calculation Applications for these vary considerably from easily inputting a week's football results into a pools predicter to plotting the fall in the pound or predicting the right time to buy shares in a depressed market

There have been teletext adaptors for computers before but few have been as cheap as this one as it not only connects to your C64 but also to your video recorder and uses its tuner to receive the teletext data. If you haven't a video, and according to Microtext most computers owners have one, you can buy a tuner as well which will increase the combined price to £124 95

Printlink/Trilogic/£34 95

Many C64 and C128 owners are now or have already upgraded to an Amiga (the recent price cut will make this move even more attractive) and those who do will be wondering what to do with their old C64 printer Instead of throwing it away, propping up a wobbly table or giving it away to a friend why not invest in a printlink and use it with your Amiga

This handy device also adds a 64K print buffer which speeds up the Amiga's notorious sluggish printing speed

Access 64/Precision/£52 10 (excluding VAT)

This similar device justifies its higher price by allowing upgrading Amiga/C64 owners to also use their 1541 and 1571 disk drives with their new machine and also includes a utility to upload precious sequential files into Amiga format and so ease the strain of upgrading

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F.S.S.L. [illegible]

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Hi-Res Fill

A better way to fill those awkward spaces

By Colin George Wilson

Over the past few months I have seen various programs appear in magazines which give alot of help to programmers where graphics are concerned I have seen programs which plot, unplot and flip points, some which draw lines and circles and others that can even move areas of the screen around But I haven't seen one capable of filling areas of the screen intelligently

There have been spray brush routines but these take no heed of anything already drawn What would be useful is a routine which would stop painting when it reaches a point already plotted on the screen

Certain professional packages such as the designer's pencil already have this facility

Most of these packages still leave unfilled areas which are in the shadow of some object already present See figure 1 as an example

In most fill routines the computer searches left to right on each line until it meets either the screen edge or a point already present and then draws a line between them However these routines often fail to recognise corners of odd shapes

The simple solution would be to re-fill these areas after the main fill has been executed, but another way is to have the computer check for such areas and then once it has filled the area as it sees it, go back and fill the remainder

I have written a program to solve this problem Originally the program was developed using Basic Lightning (I understand that Laser Basic has a very efficient fill routine built in, but as I bought Basic Lightning before it was replaced by Laser Basic, I stuck with what I had) The listing is fairly straightforward and could easily be converted to other graphic languages but as it is in Basic, it runs very slowly

The second program, a stand alone version of the first, is written in machine code and resides in the 4K above the Basic ROM and the table below supplies entry positions for both Basic and machine code programmers The source listing has been included for those of you who wish to modify the program for your own uses

Next, let me explain how the fill routine works Most people (judging by the amount of hi-res graphic and listings there are) roughly know the principles of plotting points so I will deal specifically with the fill routine

First, a buffer area is reserved for the computer to store the co-ordinates of any areas it will need to return to In Basic, this is matrix ED (number of areas, 1) In machine code, it is a 1K buffer capable of storing 255 sets of co-ordinates

The key lines in the Basic Lightning listing are explained here

10010 A buffer pointer is set to zero This counts the number of co-ordinates found and acts as an index into the buffer

10015 Two flags H1 and H2 are set to TRUE (-1) The purpose of these

Figure 1

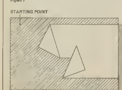
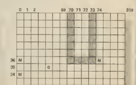


Figure 2



flags is explained in detail later on

10050 The computer now searches to the left of the start co-ordinates until it finds the screen edge or a previously set point

10090 It now performs an identical search to the right of its new found co-ordinates for similar conditions This time, for every point found blank, it is filled A subroutine is also called to check for blank areas both above and below the plotted point

10130 If the buffer pointer indicates that there are no further areas to be filled the routine finishes

10140 If not, the last set of co-ordinates stored are retrieved, and the buffer pointer is reduced accordingly

10150 This continues until either the buffer pointer registers an empty buffer or the co-ordinates retrieved indicate that the area is still blank

10160 If the area has been found blank then the fill routine is re-initiated with the new co-ordinates in mind

10170 Now that everything has been filled, the routine is TERMINATED

The heart of the program lies in the search routine This is called every time that a point is plotted on the screen by the fill routine It works in the following way

Two flags, H1 and H2 have two states, TRUE (-1) or FALSE (0), and are used to note exactly what is being searched for above (H1) or below (H2) the plotted point

If the flag is TRUE then the computer is looking for an empty point When it finds one its co-ordinates are placed in the buffer, and the buffer pointer is incremented The state of the flag is now flipped, and it becomes FALSE This state now informs the routine that an area has been found and that a possible dividing line between another such area is being sought i e a 'set' point This prevents the routine from memorising 319 dots where one or two would be sufficient It is probably BETTER understood with the aid of figure 2

The points set in column 70 and 73 and row 36 indicate where the bottom line of a rectangle lies The circle indicates the start position of the fill routine, and the 'm' signals the points that will be memorised by the computer

First, a search is made to the left for either a point or the edge of the screen The latter is found first, so the computer starts drawing a line from 0,35 Both flags H1 and H2 have been set to TRUE to look for and 'unset' points

They both find one immediately, so the co-ordinates 0,36 and 0,34 are noted H1 and H2 now become FALSE as an area has been found

Because these flags are now FALSE, the computer continues its search this time for a 'set' point

The first to find one is H1 at 70,36 This simply causes the computer to turn H1 back to TRUE to look for a nutter blank point The co-ordinates 70,36 are then forgotten as they are of no further use

The plotting and searching continues until 74,35 is reached Because H1 is now TRUE, The computer notes co-ordinates 74,36 and turns H1 back to false again

This time, the computer finishes the line without finding any further 'set' points above or below the line Now it returns to check its buffer, and three co-ordinates are found

0 34 –	below the start of the plotted line
0,36	above the start of the plotted line
74,36	to the right of the rectangle

The last set of co-ordinates are taken and tested to see if the area has been filled from another direction They are found to be blank and so the computer recalls the fill routine with these co-ordinates and this line is scanned in an identical way

10190 If we are hunting for an 'unset' point

10200 Check the point, if it is 'unset', move the buffer pointer on by 1, memorise the co-ordinates and flip the flag

10210 Otherwise

10220 Check if the point is set so that we can flip the flag the other way

10240 10280 Repeat the above procedure with the H2 flag, scanning below the plotted point

NOTE Basic Lightning uses the TOP LEFT as its origin (0,0) but the machine code version uses the BOTTOM LEFT

The memory for the machine code version is allocated as follows

$C000	$C358 M/C routines
$C359	$C7FF Free
$C800	$CBFF Buffer area
$CC00	$CFFF Hi res colour screen
$E000	$FFFF Hi-res bit mapped screen

The routines HIRES and LORES move the screen and switch video banks so that Basic loses no memory at all Locations $C359-$C7FF are available for other machine code routines The ones I have supplied are as follows

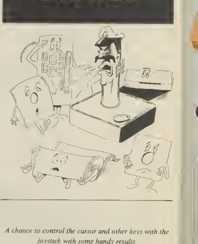
HIRES	SYS 49152	Switch hires screen on
LORES	SYS 49184	Switch hires screen off
CLG	SYS 49216	Clear the hires screen
PLOT	SYS 49470 X Y	Plot point X,Y
UNPLOT	SYS 49480 X Y	unplot point X Y
INVERT	SYS 49490 X Y	eor point X Y
FILL	SYS 49865 X Y	fill hires screen from X Y
COLOUR	SYS 49991 A	set hires colour to a (0-255)
POINT	SYS 50002 X Y	read point X Y peek 1780) returns 0 if no point set 0 if there is

Getting it all in

The Basic program 'Lightning Fill' is provided for those of you with Oasis Software's Basic Lightning program

Hi-res Fill' is the basic loader for the stand alone machine code version *See listings on page 61*

Joystick Cursor



A chance to control the cursor and other keys with the joystick with some handy results

By James Kew

This utility program allows the joystick to be used to control the cursor It can also be modified so that the joystick emulates any other keys which can be very useful for adding joystick control to BASIC programs The four files associated with this program are

JOYCURS	A BASIC loader
JOYCURS OBJ	The machine code object file loaded by the above
JOYCURS SRC	A source code file (loads as a BASIC program) for ASSEMBLER MONITOR 64
JOYMOD	A BASIC program which modifies the routine

The routine is interrupt controlled It is loaded into the tape buffer where it occupies 128 bytes, $033C-$03BB (828-955) To load the utility, load and run JOYCURS The cursor can now be moved around the screen using a joystick in port 2 Pressing FIRE and a direction emulates the following keys FIRE/UP = Return, FIRE DOWN Space FIRE LEFT = Delete FIRE/Right = Insert

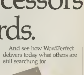
The auto-repeat can be turned on and off by poking location 922 Poking with 0 turns repeat off, with 1 turns it on

The default settings are very useful for editing programs but can be changed by loading and running JOYMOD The program here will load the machine code file and will run through the joystick directions, with and without fire, asking for each one which key that particular action is to modify If no key is to be emulated, press ← The program also modifies the default value of the repeat flag It is then possible to save the modified routine from inside the program so that it can be booted from the users own programs

(For the technically minded, the program modifies a reference table starting at 923 which contains all 32 possible combinations of the five joystick bits in sequence many of which are impossible to achieve with a joystick The table contains the CBM-ASCII values of the keys to be emulated with 0 representing no key)

See listings on page 61

W O R D
P E R F E C T



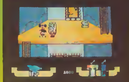
Games Update

A lot of budget releases available this month - handy if you're short of the old pennies this month

Yet another quiet month with only a few full price releases as the software companies hold back their major titles for the main autumn offensive. There is however a plethora of budget games available for anybody looking for the odd pocket money game although it must be said that a lot of these titles are previously released full price games.

Decisive Battles of the American Civil War

Marauder



Mickey Mouse

Full Price Titles

Anybody looking for a bargain could do a lot worse than investigate *Chart Busters* from Beau Jolly. It seems that even compilations are getting bigger and better as this one offers no less than twenty titles. Most of the games were originally released at a budget price and those that weren't are now showing their age somewhat but nevertheless there are some nuggets of gold among the also rans.

The titles include *Dan Dare, Tau Ceti, Rasputin, Park Patrol, Thrust, Eyeball, Way of the Exploding Fist, Ghostbusters, Olli and Lissa and Brian Jacks Superstar Challenge*. My personal favourite though is *Zolyx*, a fast thinking strategy game that shows that great graphics aren't necessary for a game to be addictive. On a score of 1 to 100 for presentation Zolyx comes in at minus five.

If you are looking for something a bit more challenging on the strategy front then there is the latest release from the Australian wargame company SSG marketed by Electronic Arts. *Decisive Battles of the American Civil War Volume II* (disk only) lets you recreate five battles including the decisive Gettysburg and Chickamauga. These two if handled differently could have turned the whole outcome of the War so here is your chance to prove that you are a better general than Robert E. Lee. As is usual with SSG games the presentation is superb and a complete construction set allows you to design whatever variants you choose.

Apart from *Netherworld* (see elsewhere in this issue) Hewson has also released *Marauder*. As with all their releases, presentation is first class but the game itself, a vertically scrolling shoot 'em up has been seen a thousand times before and offers little that is new.

From Gremlin comes *Mickey Mouse* in a game that I didn't really enjoy but which might appeal more to younger players. Mickey has to climb four towers with the ultimate aim of defeating the ogre king. *En route* he must nail shut all the side doors which involves playing four sub-games. There are ghosts and skeletons to be battled using either

Road Blasters

the magic water pistol or rubber mallet but I reckon that anyone playing the game will get more nightmares from listening to an appalling rendition of Paul Dukas' Sorcerer's Apprentice - the hit of the film Fantasia starring Mickey.

Also from Gremlin comes *Blood Brothers*, an arcade adventure for one or two players involving a chase through some mines in search of the Scorpions, a group of space convicts. Although it looks attractive, the gameplay itself left me cold and I just did not enjoy this one at all.

A racing game where you have to blast everything in sight sounds like a good idea but *Road Blasters* from U.S. Gold is yet another game that doesn't quite work. You have to get from A to B within the time limit while at the same time wiping out anything that gets in your way - cars, bikes, mines and gun turrets to name but a few. You can get extra weapons delivered to you from an overhead spaceship if your shooting skills warrant them. Graphics are poor and the scrolling is non too hot either, making control of your car somewhat difficult.

Budget Games

Firebird are the major contributers to this month's budget choice. European five-a-side is actually one of the more playable football games around. In other words, it is possible to take the ball from an opposing player. Nor are you faced with a superhuman computer controlled goalie who manages to stop everything that you kick at him.

There are problems though. Your men have a habit of all rushing up field and staying there so when the time comes to defend, there is no-one there to do it. There is also the habitual problem of control being given to the player that you don't want. The most serious fault though is that it is possible to reach a stalemate position. I became trapped between a defender and the goalie with the ball bouncing out to the corner flag and the goalie diving to save the rebound. The choices were to wait for eight minutes until the game finished, or pull the plug.

Beach Buggy Simulator sees you competing in the dune trials and what trials they are. Apart from having to jump over rocks and other hazards, there is also the slightly more serious problem of passing helicopters trying to blow you to bits. The organisers do however do you the courtesy of fitting your buggy with a gun offering some small crumb of comfort. All this is against a strict time limit with the added problem of diminishing fuel supplies.

I thought that every possible variation of title containing the word *'Ninja'* had been used up, but no, for there on the desk in front of me is *Ninja Scooter Simulator*. Apart from appearing in the title, the word *'Ninja'* has no connection with the game whatsoever but there again, I don't suppose that an ordinary scooter simulator has vast amounts of appeal. In practice, the game is a variant of a well worn theme. Race along a track within a time limit, leaping over ramps, avoiding obstacles and doing mid air tricks if you feel so inclined.

Racing seems to be this month's main theme. *American Road Race* is an old (1985) Activision game. Choose your opponents and course and head off as quickly as you can avoiding anything that gets in your way. Frequent gear changes are required and you will need to watch your fuel gauge if you are to cross the line first. There are no cars coming towards you to worry about, the only real hazard being when the screen turns black at night time!

Stunt Bike Simulator

My opinion of stuntmen is that they must have an IQ almost as low as Leeds United supporters or magazine editors. Anyone who wants to do that for a living has got to be crazy. Nevertheless, it seems that there are plenty of crazy people about and at the moment there is no law against stupidity. *Stunt Bike Simulator* (that seems to be Firebird's favourite word this month) lets you dodge obstacles as you attempt to catch men leaping off hang gliders, jump through rings of fire and try to catch hold of passing helicopters.

The theme of shoot em-ups whereby as you improve so you collect bigger and better weapons has been done to death over the past year. So what have Firebird done to add a spark of originality in *Trojan Warrior?* They have got rid of the ubiquitous spaceship and in its place substituted a man on a winged horse! And what is the object of your quest? Yes, its yet another princess that has managed to get herself captured! Don't call us, we'll call you.

The final release on the Silverbird label is *Shineys's Mine* retailing at £2.99 (all the others are £1.99). Hopping from asteroid to asteroid, you must find the entrances to the mines which in turn need to be explored in order to find and assemble bits of a spaceship. Once inside the mine, a screen can only be left when you have shot sufficient aliens to find a red diamond. There are assorted bubbles and boulders to be avoided and maps and banana bombs to be acquired. A decided novelty this month, an original idea!

Trojan Warrior

From Codemasters comes *Pulse Warrior*, a thirty two level shoot 'em up in the lines of *Trojan Warrior* above but without the originality. It is however a lot faster, more complex and better designed than its rival and represents much better value for money.

One of the most interesting budget games is *Rogue* from Mastertronic. It is a sort of one player role playing game: dungeons to be explored, treasure to be found and monsters to be bashed. The map of your surroundings is quickly drawn: all you do is use the pointer to indicate where you want to go. The pointer is also used to manipulate any objects that you find so that you can wear armour, weild (sic) a weapon, eat food etc. You have a number of hit points determining how much damage you can sustain but you must also watch your ever decreasing strength which needs food or magic to replenish it.

The game doesn't quite work in so much as it is too easy to get killed early on. One of the problems is that combat depletes your strength rapidly as well as your hits and the game tends to be over before you know it. Should you manage to survive the early stages, the use of magic items is necessary and you can save your current character to live and fight another day.

Slimey's Mine

Amiga Games

Things are also quiet on the Amiga front this month with no games that really make you sit up and take notice. Pick of the crop is undoubtedly *Bards Tale II* from Electronic Arts, an excellent although difficult role playing game. There are spells and monsters galore as you battle your way through dungeons and wilderness searching for the seven parts of the destiny wand.

Peter Beardsley's International Soccer is released at an unfortunate time, coming shortly after England's dire performance in the European Championships. The game is almost as lack-lustre. The animation of the players is jerky, the computer opponent too difficult and all too frequently the wrong player put under your control. The added features of throw ins and corners add little to the game. Best stick to playing against a friend.

Still on the sporting theme, *World Tour Golf* from Electronic Arts. Not quite as playable as *Leaderboard* it nevertheless offers a real challenge. Don't do as I did and choose the Nasty Nine for your first course when you don't really know what you are doing. Eighty-two over par for nine holes is not a score to brag about!

Return to Genesis

Giganoid

Return to Genesis from Firebird is a shoot 'em up involving the rescue of a load of scientists. Guess what? Some of the scientists can give your ship extra weapon systems. Now where have I heard that before?

Finally this month comes *Giganoid* from Swiss Computer Arts, an almost exact copy of Arkanoid. Sure, the shapes of the screens have been changed but the falling capsules are identical, even down to the letters on them. Why does 'P' represent a bonus life? Take my advice and stick to the original.

YG

Code Relocation

Post process a program and turn it into code that, with a bit of run time processing, can be relocated in any part of memory

By Dave Garside

The area of RAM between $C000 and $D000 has always been a popular area for machine code programmers The lack of interference from BASIC and the operating system makes this area ideal for small utility programs Consequently almost all utility programs published are written to run in this area

Now while this is no problem when each utility is used in isolation, it would often be nice to combine some utilities into a tool set The problem then becomes one of space and memory conflict Because the chances are that the particular routines you would like to combine occupy the same area of store

Of course there would be no problem at all if the offending code could be relocated to a different part of memory after all there is plenty of space available However 6502 code is hardly ever relocatable The reason being that because of the nature of the instruction set, it is extremely difficult to write relocatable code for anything but the simplest of programs However it is possible to post process a program and turn it into a code that, with a bit of run time processing, can be relocated to run in any part of memory The utility presented here provides the tools to perform that processing

How It Works

The easiest way to explain how the relocator works is through a simple example Consider the following piece of source code

```
           idx # 0
bl         lda store,x
           beq fl
           jsr charout
           inx
           bne bl
fl         rts
```

```
store txt "this is a very trivial example"
          byt 0
charout=$ffd2
```

Assembled to memory locations $c000 and $4c00 the above routine would appear as follows in a disassembly

```
c000 a2   00    ldx   # 0
c002 bd   0e c0 lda   $c00e x
c005 f0   06    beq   $c00d
c007 20   d2ff  jsr   $ffd2
c00a e8         inx
c00b d0   f5    bne   $c002
c00d 60         rts
c00e 54         byt   $54
c00f 48      etc for rest of string
4c00 a2   00    ldx   #  0
4c02 bd   0e 4c lda   $4c0e,x
4c05 f0   06    beq   $4c0d
4c07 20   d2ff  jsr   $ffd2
4c0a e8         inx
4cob d0   f5    bne   $4c02
4c0d 60         rts
4c0e 54         byt   $54
4c0f 48         etc
```

If
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byte
string
have
addr
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addr
both
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boun
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Figu

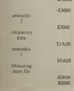
If we consider the binary representation of the two pieces of code it can be seen that the only bytes that are different are those containing the high byte of the start address for the text string 'store , the relative branches will have the same offset values, the address for charout is the same in both cases and the low byte of the start address for store is the same because both routines are assembled to start at a page boundary

This establishes the first principle on which the relocator is built – when a program is assembled to two different parts of store each starting at a page boundary, the only bytes that will differ are the high bytes of addresses that vary with the program start address And these bytes can be identified by comparing two such assemblies

The relocator does just that, but on finding a difference it replaces the byte with a marker value and stores the offset value (actual value-start address) in a table appended to the end of the program Before it can do the comparison the relocator has to decide the marker value, which must be a value that does not appear in the program being processed It does so by doing an iterative search on the first assembly until it finds an unused byte This might seem to constrain the use of the utility but in practice programs that use all 256 possible values are rare unless they contain lots of graphics

Once the program has been processed the utility appends a file containing the user end of the relocator to the beginning of the market program, and then saves out the whole package as one complete file The overall memory requirement for producing a relocatable version of a 4K utility is shown in Figure 1

Figure 1



From Figure 1 the following constraints can be deduced

(1) The lowest point in memory for the first (processed) assembly is $0800 plus the length of the boot file which is fixed at $0200 bytes

(2) The second assembly must start above the first, although it is not necessary to allow space for the relocation data as the second assembly is only processed once and it does not matter if it is overwritten by the data table

(3) The end of assembly 2 must fall below $A000

This gives a limit to the size of a relocatable program of $9400/2 bytes i e approx 18K, which is more than enough for most utility programs

The relocating boot file simply does the reverse of the relocating processing it prompts for the new start address and scans the program from start to finish for the marker bytes If it finds a marker, it looks up the relevant offset in the relocation data, adds the high byte of the new address and pokes the result back into the program.

When all the markers have been processed the program is booted to the start address and the user is prompted as to whether the program is to be executed If the answer to the prompt is positive, control is passed to the first instruction of the program Note that this is the final constraint on using this utility, the first instruction of the program must either be the run address or a jump to the real run address If the user does not want to run the program immediately, control is returned to the interpreter and the start address is displayed in decimal

Using the Utility

There are really two sets of user instructions, one set for the programmers producing relocatable programs with this tool, the other set for the end users

The user - using a relocatable program is simplicity itself The program formed by the relocator is a machine code program with a BASIC front end, so the program is loaded and run as you would a BASIC program From then on all the required information is given on the screen

The user is supplied with the length of the program and asked to provide the new start address, which is done by over-typing the default address of $C000 and pressing return (note that the start address given must be such that the boot program is not overwritten, i e the area $0800 $0A00 must not be used) The program is relocated to that address and the user is then asked to indicate whether the program is to be started straight away A negative response results in the start address being supplied as a decimal figure an affirmative reply activates the program

The Programmer – to produce a relocatable version of a program follow these steps

- Load and relocate the utility as described above, but do not run the program.
- Assemble two versions of the program to be processed according to the constaints identified above
- Now run the relocator by SYSing the start address
- From this point follow the instuctions given by the program

NB There is only limited error checking provided by the program, so ensure that disk drives, etc are connected and switched on, and there is sufficient room on the disk/tape to receive the finished program

Finally by way of an example of the increased flexibility given by relocatable programs, I've included (listing 2) a version of the public domain program 'Supermon 64' This version will relocate to anywhere in normal RAM so is really useful when developing machine code programs because you can squeeze it into any available 2K slot.

Both the Relocator and Supermon are supplied as BASIC loaders and the following procedure should be observed

- Type in the listing
- Save before running
- Run the program which will convert the BASIC data back to machine code
- At the prompt, give a filename, and at the following prompt specify tape of disk
- The program will be automatically saved and can then be tested.

See listings on page 61

A Short Interlude

We follow on from last month's explanation of how to use interrupts to carry out several tasks at once

By Michael Tinker

The routine presented this month is much more sophisticated and a lot easier to use particularly with utility interrupt programs

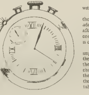
To refresh your memories (no pun intended) last month's program executed up to five interrupt routines stored in a short table This enabled varying numbers of routines to be used at once

The main shortcoming with the last program was that it was virtually essential to use a Machine Code monitor to add or remove routines from the table of interrupt routines Therefore this month I have added a "wedge" into the CHARGET routine to enable the extra facilities to be added

These facilities are a list command which will list all the interrupt addresses being called, an add command to enable addresses to be added to the table and a remove command to enable easy removal of interrupt routine addresses in the table

How does it work? First allow me to give a quick explanation of what a wedge is A wedge is a small routine placed into the operating system of the computer so that when a predetermined action takes place the wedge will pass control to your own routine

In this routine I have placed the wedge into the CHARGET routine which is used to get a character from the input buffer when in direct mode or from a BASIC program when one



is running The wedge routine first checks that the computer is in direct mode then looks to see if the first character is the left arrow symbol If it is, further checks are made to find out what the command is

For the commands I have chosen "A" for add "R" for remove and "$" for table directory The full commands are as follows

- left arrowAinterrupt #, address (in decimal)
- left arrowR interrupt #
- left arrow

For example left arrowA2,12288 will add the routine address 12288 into interrupt number two position in the interrupt table and the routine will then be called on every interrupt along with any further routines in the table

Notice that the system also stops the interrupts while it inserts the address into the table and restarts them afterwards This will prevent a complete "lock up" while the address is only partly changed

One of the features of this improved system is that when using the Mikro Assembler program listing the size of the table can be easily changed At the top of the listing is the constant called Maxint, this gives the maximum size of the interrupt table

To change the size all that you need to do is to change this one number before assembling the program The assembler will then place the correct values into the remainder of the program

The start of the program has also been written so that it will place zeros into all of the table when called Care must be taken however to ensure that any Machine Code placed after the routine does not get erased by this process Don't forget the table array uses two bytes for each address so that, for example, an interrupt table five interrupts will take ten bytes of memory

There are further improvements to be made to this system, such as adding the interrupt commands to BASIC, this however goes beyond the scope of this article but the more enthusiastic among you may wish to try

See listings on page 61

The day Roger Jackson sent his first mailshot.

May I Interrupt

Fine tuning is the key to setting up a continuous music routine

By Eric Doyle

No game is complete without sound effects and music The art of programming sound involves the impressive array of registers which forms the SID chip and though I did not intend to go into depth on this subject a little understanding of the nature of the chip is essential

Sound effects are 'spot effects' which means that something occurring on the screen is accompanied by a synchronised sound This is often better handled outside the interrupt system and music is the usual area of interest for interrupt handling

A sound has several elements, pitch, loudness and shape In reality this is a complex relationship but on the SID chip complexity has to be created The majority of programmers can never hope to reach the symphonic complexity of Rob Hubbard's work, but impressive sound can be produced with a modicum of knowledge and skillful editing

Each of the three voices of the SID can span seven octaves and the range is more akin to a violin than a piano This is because a piano has fixed notes which cannot easily be altered (tuned) Play each successive note on a keyboard and the best result is still a series of steps A violin can produce the same accepted range of notes which form the western concept of music but, by sliding a finger up and down the strings a continuous rising or falling sound can be produced which includes frequencies that are not catered for in the accepted concept of scales of equal temperament

The SID is stepped but only in small increments which can fool the ear into believing that a continuous, rising note is being produced For sound effects this is wonderful, but for music a certain degree of editing is necessary

In machine code programming, a look up table based on Table 1 is faster than calculating the value of each note's frequency All frequencies in the range have values greater than 255, or one byte For this reason each voice has two locations for the pitch frequency a low byte and high byte store

Beyond pure pitch a sound has a shape Sharply press a key on the piano and a sudden noise is produced It rises to full volume instantly and then dies away gradually bang a table and the sound appears and disappears almost instantaneously, or draw a bow across a violin string and the note will gradually build up and fade There are four elements which describe a sound shape to the SID attack, decay sustain and release Together these elements are known as the sound or ADSR envelope

Attack is the time taken for the sound to reach full volume Decay, sustain and release are related and describe the way in which the sound dies away Decay describes how quickly the sounded note falls away immediately after maximum volume is reached, sustain determines the time at which the release phase takes over from the decay and release is how quickly the note disappears Effectively decay and release are two parts of the same downward slope separated by the sustain plateau

For the piano, a short attack phase would be followed by a slow decay and a fast release, the banged table would have a fast attack followed by a fast decay and release, and the violin would have a slower attack followed by a slow decay and moderately slow release Most diagrams of the ADSR show sustain as a plateau but this is not always the case Sustain determines how long the decay lasts before release takes over (Diag 1)

Another aspect of sound shape is the waveform This can be sawtooth, triangle or pulse each name describing the oscilloscope trace which the wave produces Sawtooth and triangle are also very descriptive of the sounds that they produce – sawtooth is a rasping sound and triangle gives a gentler, ringing tone

Pulse is more variable than the other two and is as near to a pure sine wave that the digital nature of the computer can produce When using pulse a width has to be specified for the wave which determines the harmonic qualities of the sound

Getting Down To It

Machine code is far more suited to music programming than Basic On a keyboard notes are played simultaneously but the computer initiates one note at a time A chord in Basic takes time to create and often sounds as though the notes were pressed in quick succession This is similar to what occurs with code but the time delay is so short that the notes sound simultaneous

The first task in programming is to decide how to store the notes In the program example, the method used is not the most efficient but it does show the principles to best advantage and gives a basis from which to work

A note consists of a pitch and a duration To specify duration on the Commodore, the note length is based on the demi-semiquaver which has a duration of one cycle This means that the crotchet has a value of eight cycles In the code this is directly expressed by the number of repeats of the note in the data Examine the low byte data for Voice 1 and these repetitions can be seen within the numerical values

Each note has a high and a low byte so there are two tables relating to each voice

Voice 1

$C000 $C148 High frequency
$C150 – $C298 Low frequency

Voice 2

$C400 – $C548 High frequency
$C550 $C698 Low frequency

Voice 3

$C800 $C948 High frequency
$C950 $CA98 Low frequency

The spaces between the tables pairs are occupied by waveform values

$C2A0 $C3E8 Voice 1
$C6A0 $C7E8 Voice 2
$CAA0 $CBE8 Voice 3

The ADSR values and volume are constant throughout so the core routine starts with these at line 310 of the assembly code Most of the waveforms used by these ADSR values are triangular but Voice 2 uses a pulse occasionally and must have a pulse width set This is also created at the beginning of the core at lines 450 to 480

These values are constant and may be set outside the routine as long as any program running with the music does not access the relevant locations Ideally the routine should store all of the SID values at the commencement of the interrupt, set the music parameters and replace them original values on leaving

Setting the sound frequencies and waveforms is done by a self-modifying program which increments the load location where the notes are found Lines 490 to 660 relate to the fetch and poke locations for the pitch parameters and lines 790 to 960 increment the relevant locations within this routine ready for the next interrupt

The interrupt must be able to repeat at the end of the tune This means resetting all of the parameters for fetch commands To do this lines 670 to 720 test the high byte values for Voice 1 to see if location $C298 has been reached If the test proves true then control is handed to the reset routine at 730 to 780 before returning from the interrupt

If the routine was now used as an interrupt the music would rattle through at a high rate of knots Some form of tempo control is needed

Lines 250 to 300 cope with timing by aborting four out of five interrupt calls A flag is set up at location $CCFF with a value of four As each interrupt call is made this flag is reduced by one When the flag reaches zero it allows a full music interrupt to occur and resets the flag to its original value ready for another countdown

Lines 1110 onwards sets up the interrupt in the normal way remembering to include the interrupt enabling structure at 970 – 980

Musical Chores

The problem with music is that it is rhythmical This means that timing is crucial and disk or tape access will totally halt the tune but the main enemy is accompanying interrupts

Chained interrupts can be used alongside the music routine but the effect on the music can be drastic Interrupts for screen scrolling use long and short routines and care must be taken to allow for any delaying effects which these may cause Raster linking can assist by further tying the routines down to reasonable lengths

The inhibitive length of the music data as presented in the example program would obviously use too much memory for most practical purposes The contents can be greatly reduced if an indexing system is used

Set up a table of all the necessary frequency values and use a numbering system such as $01 $08, $11 to indicate the lowest note on the table held for eight sixteenth notes (a crotchet) with a triangular waveform The frequency values could then be found and poked to the relevant registers at the same time as the waveform The duration can be stored in a location and decreased each time an interrupt is called until it reaches zero Then the next value can be called up

Such a system requires quite a lot of work from the interrupt routine but does increase the flexibility of the program

The data can be pushed under a ROM to free even more easily available RAM, if the relevant changes are made to location 1 on entering the interrupt and reset on leaving

Using the Example

The example program can be tested by poking $CCC2 (52418) with $CC (204) and the next location with $10 (16) Location $CC8C should then be poked with $60 (96) and then SYS 52237 will run the tune once

When all is correct the changed values can be reset and SYS 52480 will run the interrupt.

Table 1

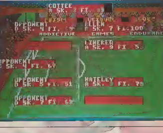
Note	Octave 0	1	2	3	4	5	6	7
C	010C	0218	0430	0861	10C3	2187	430F	861E
C#	011C	0238	0470	08E1	11C3	2386	470C	8E18
D	012D	025A	04B4	0968	12D1	25A2	4B45	968B
D#	013E	027D	04FB	09F7	13EF	27DF	4FBF	9F7E
E	0151	02A3	0547	0A8F	151F	2A3E	547D	A8FA
F	0166	02CC	0598	0B30	1660	2CC1	5983	B306
F#	017B	02F6	05ED	0BDA	17B5	2F6B	5ED7	BDAC
G	0191	0323	0647	0C8F	191E	323C	6479	C8F3
G#	01A9	0353	06A7	0D4E	1A9C	3539	6A73	D4E6
A	01C3	0386	070C	0E18	1C31	3863	70C7	E18F
A#	01DD	03BB	0777	0EEF	1DDF	3BBE	777C	EEF8
B	01FA	03F4	07E9	0FD2	1FA5	3F4B	7F97	FD2E

Football Manager II

The world's most famous football game has a sequel Football Manager caused me more bleary eyes and sleepless nights than any other game Now it's all going to start again

Much of the original game is still there, after all, why change a winning formula You still manage your favourite team and you begin your reign at the foot of the fourth division Nine skill levels decide the difficulty of the task that lies ahead and you must use your skill to pick the teams that will win you league and cup glory and buy and sell players to fill your squad and you still have to stand helpless on the sidelines while the matches are played

The first thing you'll notice when you take over the manager s chair is that the players have changed They



are still rated for skill and fitness but the Peter Withes, Gary Shaws and Tony Morleys of the original have been replaced by Gary Lineker Ian Rush Mark Hughes and Brian Robson

The fitness factor is now rated out of 100 and if a player's fitness drops below 50 he's injured and out for at least the next game The team selection has now become more meaningful as you must select players to fill forward, midfield and defensive positions Since there are four positions in each (and of course, a goalkeeper) you can't fill them all which gives you scope to change the formation and man to man markings

You can also assign two substitutes to bring on at half time to fill any gaps exploited in the first half or open up play by bringing on a winger for a defender

In the original game the outcome of a match was decided in the difference in skill totals for various areas of the field but now the more realistic player vs player match results in more action and more control over the final result For example even if the total of your three defenders is greater than the opposing attack if you leave a skill 3 forward unmarked you're asking for trouble

The games themselves consist of untimed highlights but instead of just a selection of set moves the players dribble pass and cross the ball and shoot at a diving keeper The action is still played at a snailspace after all this is no International Soccer but even slow action can get the adrenalin going in a crucial promotion or relegation battle

In between games you can alter the style of play by having extra passing practice and increase or decrease the height and length of the passes and determine whether your side is going to be short passing team like Liverpool or adopt the hit and hope style of Wimbledon and Watford There's more to this than the style of play as long high balls from defence can bypass a weak defence and get the ball straight to your forward line

Football Manager II is a richer game as the program now tells you which of your players scored the goal including midfielders, money that you receive at the end of the season to bolster your failing bank account that you squandered on a third goalkeeper comes now in the form of shirt advertising deals The deals that you're offered vary considerably and the number of deals depend on your management rating so if you're doing badly you should take the first deal offered because if you turn it down there might not be another

A longer 23 match season and two cups (FA and League) to play for will suit Football Manager fans who will wallow in every game but may put off others who prefer less thought and faster action **T.H.**

Touchline

***Title** Football Manager II **Supplier** Addictive Games (Prism Leisure) Unit 1 Baird Road Enfield Middlesex EN1 1SQ Tel 01-804 8100 **Machine** C64 **Price** £9 99 (Ca) £14 99 (Disk)*

File Extension

Now you can load and run files from a directory in a single key press with this basic utility

By James Kliemt

Normally after listing a directory, loading a file involved moving the cursor to the file name, typing LOAD, cursoring through the file name, typing either ",8,1" or "8", spacing over the three-letter file description and finally pressing RETURN File Extension permanently writes the load description to the end of any file you nominate To load a file thereafter, you simply list the directory, cursor up to the file name and push SHIFT & RUN/STOP

File Extension will work on a Commodore 64 or 128 in 40 or 80 column modes The program is in Basic therefore there are no special instructions - just type it in and save it as you would a normal program

To use File Extension, load it and type RUN You will be asked to insert a disk and press RETURN File Extension will then read the directory and print it to the screen You can stop the directory at any time by pressing SPACE If it is finished reading the directory or you have pressed SPACE, you will be taken to the main menu Here you are presented with the current file name displayed in the top left hand corner of the screen and a list of options Use cursor up and down to view other file names in the directory Pressing HOME will take you to the first file name in the directory and SHIFT HOME will take you to the last

Once you have selected the file you wish, press the appropriate key If you press 1 the computer will add ,8 to the end of the file name the load description for any basic file Pressing 2 adds ,8,1 to the file name for binary or machine language files Pressing 3 will result in a being added to the file name This is for 128 files

A number of other options exist Pressing the minus key will erase the current file The @ key allows you to access disk commands such as validate, new, etc R lets you rename the current file and P will list the directory to the printer Any time you wish to view the disk status, simply press S Once you have completed operations on a disk, press SPACE to return you to the insert disk option

See listings on page 61

Constructing a

We hope your typing fingers are in good shape as we launch into the next two programs in the FCL compiler series - the code generator and the assembler

By Steve Carrie

Although codegen may look rather complicated, its operation is very simple. It reads the SFC file created by compile and generates an assembly-language source file ASM. Codegen is able to recognise the operation codes in the pseudo code file and how many opcode bytes each should have. (These codes were listed last time.) It then uses a library of preset assembly-language lines to make up the output file. Some of these library routines simply make a call to the SYSLIB library, others are several lines long and perform data transfers between the system variables and other memory locations.

Codegen is also responsible for making the program header to allow the final runtime file to be loaded and run as if it were a BASIC file. If you already have a disk-based assembler you may not need to use the assemble program at all since it is easy enough to change the preset routines in codegen to suit your particular program.

Most of the work done by codegen is performed in subroutines, the first section of the program simply diverting control as necessary. The first task is to read in the two data files containing symbol and string information (the SYM and LTR files). These are entered into tables in a similar format to those in compile. The next task is to open the work files and generate the program header. This header contains the org directive for the assembler and this should be changed if the program is to be loaded at an address other than the default start of BASIC at 2049 ($0801). Next, the symbol and literal tables are processed. The tables are updated with information regarding the position of variables within the program. Codegen knows how much memory should be allocated to each type of variable and it also generates the literal strings in the correct format. Once this is done work can then begin on the program itself.

The code is read one line at a time and control is passed to the pseudocode processing subroutine which in turn passes control to the appropriate routine to generate the assembly source text. As you may recall, some codes require operands and each routine knows how many operands it needs and reads them as required. There are two distinct blocks of routines, those handling pseudocodes 0-33 and those handling codes 128 to 191. The latter set of codes are the keywords.

During code generation, the program keeps track of how many lines are being generated into the ASM file. The only problem that may arise here is if the disk space becomes scarce, the process will abort.

If, during code generation, a "Not Implemented" message appears, some illegal opcode has been found. This may indicate an error in compile. While on the subject of the opcodes you will need to add extra lines to codegen if you decide to extend the compiler system with new commands.

The compile program should automatically load and run codegen for you (assuming the compilation was error-free) When asked for the filename, you should enter exactly the same as you did for compile

Codegen will report the number of lines being generated as it processes the pseudocode file Upon completion, codegen will load and run the FCL ASSEMBLE program

The only possible error is the "not implemented" message which indicates that an opcode was not recognised This may mean one of two things

- there is an error in compile, or
- You have added new commands to compile without adding the necessary handlers to codegen

The Assembly Stage: ASSEMBLER

Assemble is a very basic two-pass assembler written entirely in machine code and is presented here as a BASIC loader It must be loaded and run as if it were a BASIC program only at the default BASIC start address of 2049 ($0801) The reason for writing this program in machine code will be obvious when you run compile, BASIC would be very very slow In order that the program loads at the correct address, you must ensure that it is constructed at 2049 *Before you start typing in the BASIC loader execute the following command in direct mode*

```
POKE 8192,0 POKE 44,32 NEW
```

This moves the start of BASIC upwards in memory to 8192 decimal ($2000 hex) If you are entering the program in stages make sure that you type this command every time BEFORE you start and make sure you haven't got EDIT installed!

Since I have had considerable assembler-writing experience, I didn't really need to spend time working out the routines required and coded directly into machine code Actually, the original version of this assembler was written on a PLUS/4, as was the original version of compile, and converted across to the 64

The next bit is a short user manual for the assembler which is entirly disk-based in its operation, i e there is no assemble-to-memory option available

FCL Assembler User Manual

In the following document, **boldface** characters are used to represent valid assembler directives only This program will switch the character set to lowercase mode and it should be noted that uppercase characters are only allowed in literal strings or comment lines

Getting Started

The program should be loaded as would a normal BASIC program using the LOAD command If you are using assemble as part of the FCL Compiler System, the codegen program will automatically load and run the program for you

The program file to be assembled should have extension ASM by default The program will request input of the filename, you should only enter the first part of the name e g to assemble PROG1 ASM you need only enter PROG1 when asked for the filename The assembler will produce a file with extension EXE e g for the above example, PROG1 EXE

During assembly, information will be printed on the screen relating to the current program state During PASS 1, no messages other than the pass message will be output unless an error occurs whereupon an error message is printed and assembly aborted During PASS 2, the program will be listed as it it processed Again, any errors will cause an error message to be output and the assembler will stop

On completion of a successful assembly, information relating to the start and end addresses of the program will be printed The start address of the program is deemed to be the load address Runtime EXE files should be loaded using a specially written loader or use secondary address 1 in a BASIC LOAD command, e g LOAD "PROG1 EXE",8,1

Directives

There are seven directives valid with this assembler

• byt	assemble a byte value May also be used to assemble a line of text delimited by single quotes (')
• wor –	assemble a word value (2 bytes) in 6502 lo-byte, hi byte order
• eqz –	Equate zeropage Explicitly define a symbol as type 'byte'
• eqa	Equate absolute Explicitly define a symbol as type 'word'
• org –	Set code origin Sets the assembly address and therefore the load address of the a assembled program
• res	Reserve a block of memory Memory bytes are initialised to zero
• (full stop)	Define a symbol May be followed by an equate or either byte or word type If no equates follows then the current assembly address is used, i e defines a line label rather than a symbol

Operators

The assembler accepts normal 6502 assembly language notation and addressing modes The hash (#) denotes an immediate operand and the symbols < and > may be used to define lo-byte or hi-byte operations A full list of operators is given below

Operator	Action	Example of Use
<	lobyte	lda #< symbol
>	hibyte	ldx # >symbol
+	add	lda symbol+1
-	subtract	ldx symbol-1

Numeric Types

Only decimal and hexadecimal types are catered for A hexadecimal number must be prefixed with a dollar or ampersand while a decimal number need no prefix at all For example

$8000 as in lda $8000 means address 8000 hex (32768)
8000 as in lda 8000 means address 8000 decimal

Error Messages

Error messages may be printed out by the assembler during either pass 1 or pass 2 Errors during pass 1 are normally syntax-type errors where the programmer has misspelt a word or used an illegal character sequence Errors during pass 2 include those of pass 1 and also symbol type errors such as relative branch range errors

These error messages are listed in Fig 1 and are printed in either of two formats During pass 1, the line in which the error occurred is printed and the error message is displayed below it During pass 2, the program is being listed anyway so only the error message is displayed

Assemble Error Messages

Undefined symbol error indicates that a symbol has been referenced but has not been defined using the directive (full stop)

Redefined symbol error indicates that a symbol has been declared twice or more times

Mnemonic not recognised the mnemonic found was not a standard 6502 type or assembler directive

Bad symbol error means that a symbol was syntactically incorrect

Illegal Operand field occurs when an operand is syntactically incorrect

Illegal Mnemonic field – indicates that a mnemonic was expected but something else was found instead

Missing operand error – an operand was expected but was not found

Disk file error file is missing or possibly the disk is faulty or full

Syntax error – this is a general message, possibly indicates a bad operator

Illegal quantity error indicates that a numeric literal was out of range ie too big

Illegal addressing mode indicates that you have tried to use an instruction in an incorrect addressing mode

Not X or Y index – only X and Y index registers exist on the 6502 You have specified an incorrect index

Symbol table full – assembly cannot continue due to lack of symbol workspace

Branch range error – relative branch instructions have a range of -128 or +127 bytes You have exceeded these limits

Example of an assembly language source program.

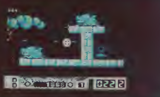
```
10   ; Example program
20   ;
30   org $c000
40    border eqa $d020
50    screen eqa border+1
60
70    start ldx # 0
80   stx border
90   stx screen
100  inc border
110   loop1 inc screen
120  lda screen
130  cmp # $0f
140  bne loop1
150  inc border
160  stx screen
170  lda border
180  cmp #15
190  bne loop1
200   exit
210  rts
```

Note the use of the symbol declaration directive (full stop) and the combination of symbol label and instruction in line 110 Lines 200-210 show how you may place these on separate lines Remember that the org directive not only sets the code origin, it also sets the file load address on the disk This is important because the address defaults to $0000 Loading a file at this address will almost certainly crash the machine!

So now you have EDIT, COMPILE, CODEGEN and ASSEMBLE Next time I will present the final part of the system, the SYSLIB runtime library and some example programs will also be included

See listings on page 61

Netherworld



I used to think chocolate milk was addictive! Netherworld is definitely a game to test your willpower as much as your joystick skills. I haven't been so hopelessly addicted to a game since Boulderdash (to which this game owes more than a passing resemblance) Jukka Tapanimaki may be testament to the programmer's art in Finland, but this man is obviously in need of psychiatric help!

Trapped in a fantasy world with nothing more than your multi-firing gyrosphere to protect you the only way back to normality (?) is by battle and bribery Acid, bubble-belching dragons are your worst enemy but never forget that time is no friend either Steer your ship around the maze collecting diamonds and egg timers (the latter extends your time limit in your favour) until you have enough diamonds to bribe the guardians of the teleports into letting you proceed Until then, you can only use the teleports for 'local' trips, these being quite useful once you've worked out where each one deposits you Shooting acid bubbles can produce items that when collected help you on your way increase your score, or merely serve to hinder you

After succesfully completing level one, a devilishly tricky bonus round is your next task, although completion is not obligatory By pushing moveable rocks into positions, the flying blob is directed into the converter grid a valuable extra life can be collected

Levels two and beyond are infinitely more difficult with the inclusion of 'nasties' generators, alien eggs moveable rocks and various other hurderances

Although the game plays reminescent (to me anyway) of Boulderdash (collect-all-the diamonds-and-the exit-before the clock-runs-out) the graphics belong to the age of Uridium (ultra-smooth ultra-fast scrolling) and IO (imagine-your-worst-enemy's-worst nightmare) Your gyrosphere responds well under joystick control, its 'natural' inertia took quite a bit of getting used to – a lot like Paradroid (I don't like drawing comparisons like this but sometimes it's the only way!) Chancing the mystery bonus (after shooting acid bubbles) can provoke some weird results your gyrosphere can suddenly respond back to front and upside down (inverting your joystick gets you out of this quite nicely) or you could lose control completely for a while On the plus side you could gain extra speed a demon killer or be able to knock out bricks The latter two features are cumulative not to mention essential to solving the higher levels

Soundwise, the inter-game music narrowly escapes 'disgustingly bad' but knocks spots off one or two Amiga soundtracks I could call to mind! Sound effects (muzee speek ekwivelent SOWNDEFX) are useful rather than tuneful and so they should be

Well done Hewson (nice press do) more of the same please! This Finnish geezer is pretty hot stuff the bonus round is probably worthy of a game on its own! It's pretty rare for one of my reviews to have nothing but praise so take a pat on the back all round I only hope I can squeeze my meals in between attacks of Netherworld

F R

[illegible]
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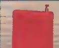

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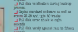

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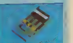

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Set the Alarm!

Has there ever been a time when you've been so absorbed with programming your 64 that you've been totally unaware of the world outside? If so then help is at hand with this routine. Just type in Alarm and you'll never miss the start of your favourite telly program again or even worse last orders at the Dog and Fox

By Nick Gregory

Alarm turns the 64 into a digital alarm clock while still allowing you to use the computer normally The program works on interrupts, checking every 1/60th of a second to see what time it is and whether or not its time to sound an alarm There are four ways to use Alarm which I will demonstrate with examples

```
SYS 49152
```

This turns off the Alarm routine and returns the C64 to normal

```
SYS 49152,"P0800", "P1045", "LAST
ORDERS NOW"
```

This sets the actual time to 8 o'clock pm and the alarm to 10 45pm. When 10 45 is reached then the message "LAST ORDERS NOW" will be flashed in the top left hand of the screen The message will be flashed on the screen until you use the first command (or RUN, STOP and RESTORE) to turn it off You can set the time or alarm to am by using an A' rather than 'P' in the time string For example "A1000' is 10 o'clock am

The time strings must start with either an 'A' or a 'P' otherwise you will get a syntax error and they must contain the time in the format HHMM within the natural ranges otherwise you will get an illegal quantity error The message can be anything you want up to 26 characters but it shouldn't contain control codes or cursor controls, just ordinary printable characters Again if you exceed 26 characters you will get an illegal quantity error

```
SYS 49152, "P0800", "P1045", "LAST
ORDERS NOW",1
```

This is exactly the same as the example above except that the time will be continually displayed in the top right hand of the screen The time is printed in hours, minutes and seconds though you can not set the time to seconds An 'A' or a 'P' is also displayed to tell you if it's am or pm If the final value in this example is greater than one you will get an illegal quantity error, if it is zero then the command is the same as in the last example

```
SYS 49152, "A0000", "A0010", "TEN
MINUTES ARE UP"
```

This example shows how you can use Alarm to time specific periods The alarm will go off in ten minutes time It doesn't matter in this case if you use am or pm but the routine expects one or the other Putting a 1 as the final value (as in the last example) will display the clock continually

Before you set the times you should know how the clock works The clock will tick away from A1200 to P1200, there are no A0010 except as I've just described above For example, five minutes past mid-day is written as P1205 and five minutes to mid-day as A1155 Likewise five minutes past midnight will be A1205

As Alarm is an interrupt routine you should be extra careful when typing it in because the 64 will most certainly hang up on you if you've made a mistake and remember the golden rule SAVE BEFORE YOU RUN

See listings on page 61

Hires/ Multicolour Plotter

Sacrifice your horizontal resolution to combine multicolour and high resolution mode

By Daniel Ansari

None of the plot routines that I have so far seen in magazines were intended for use by the machine code programmer, neither were they able to be used in multicolour mode as well as hires mode Multicolour mode is a nice feature of the Commodore 64 allowing up to four different colours to be used in a single character square, unlike the two colours in high resolution mode There is, although a sacrifice in horizontal resolution, which is halved to 160 pixels

The routines available plot/unplot points, test them, draw/undraw boxes of any size and shape, clear the hires screen enter hires mode, enter text mode, colour the whole screen, and load and save screens

When used from Basic the only POKE command needed is to tell the routine whether you wish to use hires mode or multicolour mode All the other instructions from now on are simple SYSs with the parameters separated by commas I have eliminated the need for several POKE instructions as well as an SYS, when one SYS and no POKEs greatly

POKE 254,m	Sets the mode, where m is 0 or 1 for hires or multicolour mode respectively
SYS 49152,x,y c,b	Turns a point, of co-ordinates (x,y) on or off x is a number from 0-319, y a number from 0-199, and c the point colour; in multicolour mode it is a number from 0-15, in hires mode it is a number from 0-255 calculated by 16* point colour (0 15)+ background colour (0-15) b is the brush in hires mode 1 or 0 for on or off, in multicolour mode 0 for off, or brush number 1-3
JSR 49193	The machine code version of the above Before using this instruction, store x in locations 50177/8 in the order LSB MSB, and store y in 50179 c and b should be put in locations 50183 and 50184
SYS 49340,x y	Tests a point of co-ordinates (x,y) The number in location 50192 is 0 if the point is off, and greater than 0 if it is on In hires mode, the number in 50193 gives the point colour and background colour together The point colour is calculated by INT(n/16), where n is the number The background colour is n-INT(n 16)*16 and can be calculated even if the point is off In multicolour mode location 50193 contains the point colour (0-15)
JSR 49378	Tests a point Only x and y are needed in locations 50177 9
SYS 49634,x,y,w,h,c,b	Draws/erases a box of top left co ordinates (x,y) where w is the width (0 319-x) and h is the height (0- 199-y)

simplify the task of creating graphics, and also make the process considerably faster

From machine code, this is a little more complex It is not possible to enter parameters separated by commas in this language, even though it is much faster The values for the parameters must be POKEd into certain locations which are described later on Every effort has been made to keep these locations down to an easily memorable level

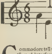
The demonstration program illustrates the capabilities of multicolour graphics reasonably well, but I'll leave it up to you to create your own masterpieces If you do not have an assembler, then type in the Basic loader program. Don't worry if you make any mistakes – the program will tell you exactly where to find them

When you have run your Basic loader program successfully type in the memory save program and the plot routine will be saved to tape or disk.

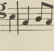
The instructions to use are as follows, with SYS as the Basic instruction and JSR as the machine code (assembly language) instruction

JSR 49675	The m c box instruction, where w is held in 50180-1 and h is held in 50182
SYS/JSR 49867	Clears the hires/multicolour screen at 8192
SYS/JSR 49897	Enters hires/multicolour mode, depending on the contents of location 254
SYS JSR 49926	Enters text mode
SYS 49951 s,t	Sets screen and border colours, where s is the screen colour, and t is the border colour In multicolour mode each parameter ranges from 0 15, in hires mode s is a number from 0-255, calculated by 16* point colour+background colour (the colours of all the points on the hires screen can be changed with this instruction) t is a number from 0-15
JSR 49974	Before using this instruction, load the x register with t, and location 253 with s
SYS 50005,d	Saves the hires/multicolour screen with device number d d can be 1 or 8, for tape or disk This instruction can only be used in program mode this is because if a screen is saved in immediate mode it becomes corrupted as you type in the command
JSR 50019	The m/c save instruction Load the x register with d
SYS 50128,d	Loads the screen Please note that the screen can be loaded while still in text mode
JSR 50142	Loads the screen from m/c Load the x register with d before calling this routine As with the save routine, this has to be used in program mode

See listings on page 61



Making Music



Commodore tell us that the SID (Sound Interface Device) Chip is a single-chip, 3-voice electronic music synthesiser/second effects generator compatible with the 6510 and similar microprocessor families It has the following features three tone oscillators in the range 0-4 kilohertz (one hertz is, you may recall, one cycle per sound), four waveforms per oscillator and these are of course our familiar triangle, sawtooth, pulse and white noise, three amplitude modulators, with a 48 decibel range three envelope generators, featuring exponential response, an attack rate varying from two milliseconds to eight seconds, a decay rate varying from six milliseconds to 24 seconds, a sustain level varying from 0 to the peak volume level, and a release rate which also varies from 6 milliseconds to 24 seconds They all, of course, vary from zero milliseconds to whatever the maximum setting might be This was all seen to ample effect in the ADSR settings program

Oscillator synchronisation, which we have simply referred to as synchronisation and which requires the voice being synchronised to be at a lower frequency than the one it is being synchronised with, but preferably at a higher frequency than zero!

Ring modulation, which we have dignified with the full term and which, as we have seen, requires a triangle waveform in order to operate properly

Filtering techniques, which again have been covered in some detail Commodore call them oscillators, we call them voices!

However these are just words and actions (or at least tables) speak louder than words The Commodore 64 manual obligingly gives us the high and low value frequency settings for a range of notes, but in order to obtain the frequency value of an unspecified note in a form suitable for turning into a high and low value frequency we must use the formula.

```
F Freq/0,06097
```

where Freq is the value we want, and F is the frequency of the note in question Having got Freq we can find the high and low value frequencies (FH and FL) from the following equations

```
FH=INT(F/256)
```

```
and FL-F-(256*FH)
```

All this assumes that F is an integer value by the way

The ADSR settings, with talk of milliseconds and seconds, sounds all very grand, but in terms of actual numbers and values to be POKEd into memory the following table tells us all we need to know

Decimal	Hexadecimal	Attack	Decay/Release
0	0	2	6
1	1	8	24
2	2	16	48
3	3	24	72
4	4	38	114
5	5	56	168
6	6	68	204
7	7	80	240
8	8	100	300
9	9	250	750
10	A	500	1 5 secs
11	B	800	2 4 secs
12	C	1 0 secs	3 0 secs
13	D	3 0 secs	9 0 secs
14	E	5 0 secs	15 0 secs
15	F	8 0 secs	24 0 secs

The times given are all in milliseconds, unless otherwise specified

You'll see from this table that not every setting is possible, although the number of different ADSR settings available (256 * 256, or 65536) should be more than enough for most people It isn't, for example, possible to get an attack rate of 30 milliseconds, or a decay rate of 500 milliseconds, but such minor problems should really be overlooked in the face of what we have got

Combine the number of possible ADSR settings with the number of different notes we can play, the variations on ring modulation and synchronisation, and in particular the number of different filter types and filter settings (combining resonance and cutoff frequencies of different values) and you'll soon realise that it is a foolish man who can claim to know all about the SID chip and its workings

Conclusion

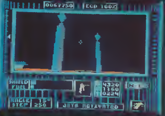
During the course of this foray into the inner workings of the SID chip we have encountered many musical marvels and have come close to talking about everything that the chip is capable of doing Envelopes, modulators, synchronisers, filters have all been discussed, and the sound effects and musical tunes that we can produce have a virtually infinite range

The major programs presented will help you to understand how the chip functions and how its various features can be utilised to best effect

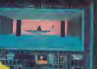
However, in the end it is of course up to you, the user of the chip, to get the best out of it, and the only way to do that is by experimenting No one can hope to commit to memory all of the wonderful effects that are available to us when using this chip No, the only route is through continuous experimentation, fiddling about with programs, changing the values stored in registers, altering what goes where and seeing what happens as a consequence

I encountered my first, very humble, 'synthesiser' program for the Commodore 64 back in the early months of 1983 over four years ago I still use that program, and I'm still learning how the chip itself operates, and how I can ever possibly hope to understand all its inner workings and create every sound it's capable of! If you've just started, try not to despair!

See listings on page 61



Dark Side



In a month of sequels (Football Manager II, The Games – Winter Edition) non is more impressive than the sequel to Incentive's Driller, Dark Side

This is the second in the games to feature the Freescape 3D system that creates solid images and gives you millions of possible views of those objects The views you will see are of the moon Tricuspid which is the second moon of the planet Evath

On its surface the Ketras are planning the destruction of Evath and are building a massive energy weapon called the zephyr one This massive machine of destruction is powered by a line of Energy Collection Devices (ECD's) Your mission is to knock out the Zephyr one and your only chance of that is to destroy the ECD's that feed it with power

As the game begins you are dropped on the light side but your quest lies on the dark side of the moon There you will find ECD's and the Zephyr one that are guarded by Plexor tanks that automatically open fire when you come into range Some regions that you will need to go are restricted and can only be reached through telepod towers but you will need to find telepod crystals to operate them

First on your agenda must be to find shield plates for more protection and fuel rods to power your jetpac that can get you in and out of so much trouble

The Freescape system almost gives you the feeling that you're there as you can fly over, around and into buildings and objects scattered around the planets surface Inside the buildings you will find puzzles to solve and hidden trapdoors but the main puzzle will be how to knock out the ECD's Although all you have to do is blast away its crystal at the top of the tower but unfortunately if the ECD you've knocked out is connected to more than one other, and most are it simply regenerates Therefore, you must scout out the moon carefully to find the ends of the line

However, time is also against you as the Zephyr one is already building up its power bringing the destruction of Evath closer and also making it more difficult for you to destroy

The view of the planet is seen through the helmet of you the Evath agent which is dominated by the Freescape 3D view of the moon's surface but below that are instruments that show the co-ordinates of your current location, the sector you are in, a compass, and current shield and fuel levels

Once you've played your first game of Dark Side, Evath will have been destroyed and you in the vain attempt to save it but you will be convinced of two things Firstly, it often takes a couple of games for a new system such as Freescape to settle down since it is only then that the development team concentrate on the plot and that Dark Side is one of those rare games that is both pretty to look at and a challenge to play

T H

Touchline
Title *Dark Side*
Supplier *Incentive,*
Zephyr One Calleva Park,
Aldermaston, Berks RG7 4QW
Tel. *07356 77288* ***Price*** *£9 95*
(Ca) £12 95 (Disk)

The President is Missing

The President is Missing not only launches an intriguing detective style investigation but also a new style in games from US software house Cosmi Cosmi made the news a few weeks ago with its move from the US Gold stable when it signed a UK joint venture with Microprose which was also once imported by US Gold

With the move it has left behind its old less than subtle style of game, that included the blood and guts of Forbidden Forest and Aztec Challenge and the taste shown in games like Chenobyl The President is Missing is a high quality investigation backed up with two double sided disks an audio tape and booklets and documents to set the scene

The President and incidently nine other western leaders, were supposed to be at a summit in Switzerland but the venue was switched at the last moment to somewhere in Lichtenstein Last night two army helicopters carrying armed terrorists stormed the meeting place and abducted the leaders Because of the grave crisis the Vice President has appointed you as Special Investigator making it your job to find out who perpetrated the abduction bring them to justice and bring about the safe return of the leaders

To help you in this onerous task you have access to the federal databases, agency reports, government documents, public and private records, intelligence files and a team of eight field agents These files are stored on the four disk sides, but there is just so much information available that you must approach the case logically or get drowned in a sea of data

A reasonable place to start is the official report of the kidnapping but more tempting is the audio tape included in the game box This is packed with potential clues as well as a fair helping of red herrings and includes recordings of phone taps a speech made at Oxford University several years earlier ransom demands from the kidnappers and statements from the President and the French Premier This piles on the atmosphere and sets you scribbling frantic notes about names and places that crop up and some intriguing morse code that appears at the end of the tape that was intercepted by your intelligence services that is guaranteed to send you racing for the encyclopedia to find out its meaning

On side three of the disk there are ten photo files to send the investigating buds as you scour the images with the zoom option to look for the vital clue Almost at once you're beginning to get suspicious

The kidnappers claim to be Islamic fundamentalists and demand among other things the destruction of the state of Israel, the withdrawal of western influences and puppet governments and the return of all Islamic assets The voice of one of the kidnappers sounds similar to the speaker at Oxford who describes terrorists as heroes and freedom fighters However, the meeting place was only disclosed to security agents and the leaders themselves hours before (they had only be warned of it being within 50 miles of Zurich) which suggests at least some inside knowledge and perhaps a traitor Add to that the use of the abductors of Russian made gas bombs and a Russian trawler within range of where the abductors drop out of radar surveillance and you have the scope for some interesting theories

However, theories on their own won't win the game and so you need to delve deeper into personal and private files and put your field agents to work These can take any orders, go anywhere in the world and report back to you but the skill is deciding where to send them and ensuring their orders are clear enough to avoid time wasting and wild goose chasers

The President is Missing is a fascinating game of international intrigue and although reminds you of the first part of the Fourth Protocol game the depth and attention to detail put it in a class of its own

If solving the game isn't enough to satisfy your curiosity, and this should take several weeks of sleepless nights, then you can take up Cosmi's offer to send in your conclusions and evidence to help prosecute the offenders in return for the juries decisions

T H

Touchline

Title *The President is Missing* ***Supplier*** *Cosmi (Microprose), 2 Market Place, Tetbury Gloucs GL8 8DA* ***Tel.*** *0666 54326* ***Machine*** *C64 disk* ***Price*** *£12 95*

Sprite Library

It's back to the ABC in this month's delve into the Library

By Mike Benn

The alphabet takes on a shady appearance this month The individual characters are based on a single sprite definition Use the table to decide which characters you need, they are in alphabetical order so it should be easy to calculate which letter you will need The C64 allows up to eight sprites on the screen at any one time which should meet most needs If you require more sprites on the screen, I recommend *Split Sprite* by S J Chance (YC April 1987) which allows up to 32 sprites on the screen at one time

Multialph — Multicolour

HEX	DECIMAL	DESCRIPTION
A0 — B9	160 — 185	CAPITALS
BA — C3	186 — 195	NUMBERS
C4 — DD	196 — 221	SMALL LETTERS
DE	222	CIRCLE
DF	223	SQUARE

Getting it all in

Type the basic loader as published and SAVE IT-DON'T RUN IT or it will self-destruct and, possibly, burst into flames Before running the loader program you will need to reset the computer and type directly the following

```
POKE43,0 POKE44,64 POKE16384,0

NEW
```

and press return This will trick the computer into believing that the basic now starts at $4000 instead of $0801 Load in the basic loader and run it,if error free, the program will automatically save as a block of data If you reload that data in the future remember to add a 1 alter the device number The data is saved in the following location $2800-$37FF

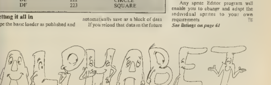
The sprites run from 160 to 223 in a compromise to avoid the area $2000 traditionally set aside for redefined character graphics and to avoid the need of typing in line after line of data

If only one or two sprites are required then use this formula. (Sprite block No — 160) *40 + 190 - the data line number at which that sprite blocks data starts Remember to type in the following three lines of data and alter the variable BL to the number of data lines you have in your finished program, less 1

The small basic program M ALPH DISPLAY will variously animate the sprites in both non-expanded and expanded forms on the screen simultaneously To hold on any sprite enter the same number for Start and End.

Any sprite Editor program will enable you to change and adapt the individual sprites to your own requirements YE

See listings on page 61



The mysteries of the CP/M+ context editor explained

By Alan J. Wills

CP/M+

A few years ago I upgraded my trusty Commodore 64 for a new Commodore 128D I was persuaded by slick advertising that I would be receiving three computers in one package What really clinched the deal was the prospect of using CP/M+ I had worked with Wordstar, which runs under CP/M, and was excited by the prospect of using CP/M+ to run business programs from public domain software suppliers

When my 128D arrived I immediately tried the CP/M+ system disk supplied with the computer I was not impressed with the screen display and wondered how I could make use of my new operating system

I soon found out that CP/M had many different formats and I would not be able to readily obtain programs from software suppliers Indeed it became very obvious that I could do very little with CP/M+ unless I was prepared to study and work on practical exercises The section on CP/M+ in the Commodore 128 handbook gave an inkling of what to expect, but no real guidance

Recently I saw a series of articles on CP/M+ and the 128 in *Your Commodore* I obtained a handbook on CP/M+ and over a few months I managed to glean enough information to use several of the transient programs supplied on the CP/M+ system disk.

Commands for operating the transient program, ED, will be demonstrated and it must be emphasised that only the basic commands will be shown It will be up to the individual to progress onto more advanced techniques after some understanding of the program has been reached ED is not "user friendly" and at first might seem impossible to use, but ED is one way of entering text or assembly language programs into a file

The real problem with ED comes when text from an existing file has to be amended or edited Text is loaded into a buffer and edited in the buffer before being saved to disk in its new form. Unfortunately the cursor does not perform its usual role, instead a character pointer called CP, which is invisible, is used for positioning in the buffer Think of the buffer as a graph with CP positioning across the top and line positioning down the left hand side The text being the actual area where plotting takes place However the CP must know where it is at all times, so it is important to set CP at the start of the buffer

After using ED for some time its editing system will become familiar and although rather slow to use with a great deal of counting necessary it at least gives the user a method of entering text into a file without the added expense of a more advanced editor

I have compiled a summary of ED commands used in this article and it would be useful to have them at hand for reference as the exercises are worked To make sure that ED is on the CP/M+ disk enter DIR at the system prompt and check the directory for ED If it is on the disk then remove the disk and switch off the computer

Loading ED

The following instructions load ED into the computer memory from the system disk Place the CP/M+ disk containing ED in the default drive then switch on the drive and the computer (only if 128D) The system disk will auto boot and stop with the CP/M+ system prompt A> At the prompt enter the following

```
>A ed text txt press RETURN key
```

The file text txt is used for demonstration purposes only and in reality any file name can be used The txt after the file name is useful to identify a text file on the disk directory The words NEW FILE will appear on the screen When the drive stops the screen display will display * Before entering text into the file it is important to understand the operating modes of the Ed program

Operational Modes

ED has two modes – COMMAND and INSERT In COMMAND mode the prompt displayed on the screen display is * In this mode commands can be entered one at a time or if more than one command is required in a continuous line with one command following the other, spaces are not required Commands can be edited before the RETURN key is pressed Use the CRSR right and left key to position the cursor then the DEL key to go to erase the character

If the letter i is entered at the prompt and RETURN key pressed ED enters the INSERT mode In this mode ED inserts text directly into the memory buffer

ED will generate a line number for reference followed by the prompt Editing in this mode is carried out by moving the CP, which will be explained later A complete line of text can be deleted by using the CURSOR DOWN key immediately above the £ key Spaces can be inserted into the text, by using the SPACE BAR

Entering Text on a File

The next step is to enter text into a disk file WARNING – it is not an easy matter to correct mistakes after text has been entered into a file so it is worth checking the text before the RETURN key is pressed At this stage it does not matter if the command letters are in upper or lower case both work equally well, with the exception of the letter i which must be in lower case

Enter the INSERT command letter i at the ED prompt A lower case letter i will result in text being displayed in upper and lower case Press the RETURN key and the screen will display I', ED is now waiting for text

Context Editor

to be entered into the buffer Enter the following lines of text and press RETURN at the end of each line

```
My dear son James, the head of the family
died on 2 September 1834
Thus death, or rather the conqueror of the last enemy,
has said, hitherto shall the immediate Branches of the
Family Tree go and no further
```

When line 6 prompt is displayed enter CONTROL Z (CONTROL key & Z together) and press the RETURN key The CONTROL Z sequence will not be displayed on the screen The screen display should now look like this

```
A >ed text txt

NEW FILE

          *1

1  My dear son James, the head of the family,
2  died on 2 September 1834
3  Thus death, or rather the conqueror of the last enemy,
4  Hath said, hitherto shall the immediate Branches of the
5  Family Tree go and no further
6  CONTROL Z (not displayed)
```

The CONTROL Z sequence switches off line numbering and forces ED to enter the COMMAND mode To save the file for future use, enter the EXIT command letter E at the prompt and press the RETURN key ED will save the file text txt and make a backup copy This file will be used in exercises to demonstrate various ED commands

The Buffer

At this stage a brief description of the text buffer might help you to understand its complexity Text is entered directly into the memory buffer from the keyboard The size of the buffer can be determined by the 0V command entered at the prompt followed by the RETURN key the display on the screen will give free space/buffer size When the command is executed the screen will display 38271 38491 The LINE NUMBER command letter N allows movement through the lines of text in the buffer and is executed by entering a line number at the prompt

The line selected is displayed on the screen, unlike the LINE command L which only goes to the line number and requires a further command to display text. The B command sets the CP at the start of the buffer and -B puts the CP at the end of the buffer ED then enters the COMMAND mode and displays the command prompt * Enter B0P at the prompt to display text from the start of the buffer The letter B moves the CP to the start of the buffer and 0 (figure 0) followed by the letter P displays half the buffer to the screen The B0P command will be used extensively in the coming exercises to set the CP at the start of the memory buffer and print the file

Viewing an Existing File

Now let's view the file text txt created earlier and saved to the disk using the EXIT command Before any viewing takes place the file MUST be loaded into the buffer To do this use the APPEND command letter A is be used Decide on how much text you want to view at one time and enter one of the A commands at the ED prompt, then press the RETURN key

Saving Text File

You have already saved the file text txt using the EXIT command letter E Here are two other ways of saving files The HEAD OF FILE command letter H, saves the contents of the memory buffer without leaving ED and sets the CP at the start of the buffer This allows re-editing without having to load ED again

If you make a mess of the text file and want to return to the original file then use the ORIGINAL command letter O This command will abandon all changes made to the text file and returns to the original file ready for re-editing again without the ED session The O command differs from the E and H commands as you are asked to confirm the validity of the command by the prompts O (Y/N) Enter Y or N and press the RETURN key and leave the computer and disk drive to do the rest

Loading from an Existing File

Now to get down to the serious work of editing a text file To re-call text previously entered into a file enter the following line at the system prompt

```
>A ed text txt          press RETURN
key
```

ED will load the file text txt ready for editing Use the combined APPEND #A and PAGE 0P commands to display text on the screen from the buffer The screen will display the following

```
A >ed text txt
        * #A0P

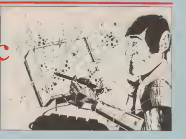
1. My dear son James, the head of the family,
2  died on 2 September 1834
3  Thus death, or rather the conqueror of the last enemy,
4  hath said, hitherto shall the immediate Branches of the
5  Family Tree go, and no further
1 *
```

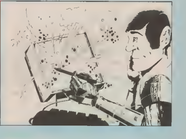
I'm afraid space doesn't allow us to print the whole article Watch this space for the concluding part

See listings on page 61

Win a Bionic Arm!

Your chance to win a fantastic Robotarm from Datel!





We've teamed up with Datel for this month's competition spot the difference and the lucky winner could walk away with a Robotarm and software worth £50 The next four entries out of the hat will each receive Blazing Paddles a combined light pen and graphics package system So what are you waiting for?

How to Enter

Study the two cartoons on this page there are a number of differences between them Once you have decided how many differences there are, complete the entry coupon and send it to the editorial address (see coupon) Write the number of differences that you have found on the back of the envelope If you don't your entry will not be accepted

The Rules

Entries will not be accepted from employees of Argus Specialist Publications and Datel This restriction also applies to employees' families and agents of the companies

The How to Enter section forms part of the rules The Editor's decision is final and no correspondence will be entered into

Detal Entry Coupon

Name ....

Address ....

.... Postcode ....

Number of differences found ....

Closing date 31st Oct 1988

Post to Your Commodore
Datel Competition
ASP Ltd
1 Golden Square
London W1R 3AB

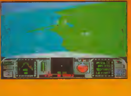
Interceptor

A[illegible] Hornet [illegible] as technology [illegible] certainly know [illegible] victim was impaled [illegible]. By the time a squadd[illegible] taking pot shots at people [illegible] person disappeared, the squad [illegible] had hit his target or the man had just d[illegible] down.

It is the same with air warfare. Gone are the days of the silk scarves, goggles and shouting 'Tally-Ho [illegible]' [illegible] you waved to your opponent before blasting him out of the skies. Now all you get to see is a small blip on your radar screen at which let loose the odd missile or two. It [illegible] a bad show [illegible] you actually get to see your opponent.

Two of the latest killing machines are the F-16 Fighting Falcon and F/A-18 Hornet, pride of the American ground and naval forces respectively. Interceptor from Electronic Arts puts you in charge of either in their latest Amiga game.

As combat simulators go, Interceptor falls somewhere in the middle ground. You do not have to wade through hundred page manuals before you discover how to take off. Nor is the documentation so sparse that you are literally flying on a wing and a prayer. Instead, there is a twenty four page manual, most of which is taken up with diagrams.



What the program does instead is to take you through a series of training flights. At the simplest of levels is free flight. There are no enemies or targets, just you alone in a big empty sky getting used to the controls of your aircraft.

The next stage is the easiest of all. You don't do anything as you sit beside your training officer as he demonstrates the seven basic combat manoeuvres: the aileron and barrel rolls, inside and vertical half loops, break turns, inverted [illegible] laying at[illegible] that y[illegible] [illegible] Take off from the [illegible] with any enemy [illegible] before [illegible]ding and [illegible] successful mission [illegible] being passed fit for active duty.

[illegible]trols of your plane are reasonably s[illegible] [illegible] with m[illegible] of the keys used being sensibly ar[illegible] [illegible] to remember [illegible] R for range, T for target, [illegible] for map and so on. [illegible] once in games of this type I found that the combination of joystick and keyboard easy to manage so that I could stay airborne long enough to be shot down rather than going into a power dive from t[illegible] thousand [illegible]t as I struggled to find the right button to press! The head up display, which throws an image of the vital information onto the canopy, proved more th[illegible] useful and saved forever having to look down at th[illegible] instrument panel. Ironically, the control that gave me the most trouble was the security wheel included in the pack to stop piracy.

You have a variety of weapons available at your dispos[illegible] AMRAAM medium range missiles, Sidewinder short range missile and a close range cannon. Naturally it would be unfair to expect your opponent to fight back armed only with a pea shooter so it is necessary to make use of chaff flares and electronic counter measures in an attempt to divert the bad guy's missiles. The only problem with these is that they do tend to advertise your presence somewhat.

One of the most unusual features of Interceptor is the number of different views that you, the pilot, can obtain. You can look out of your cockpit left or right, up or down and forwards or backwards. As if that wasn't enough, you can also get third person views of your aircraft, i.e. someone standing right next to you but outside the aircraft, again from the same bewildering set of angles. Why you should want to do this in actual combat, I haven't yet discovered, but you must admit, it does look impressive in the photographs!

Interceptor has got the balance just about right between complexity and gameplay and the game should provide many hours of entertainment to any would be latter-day Biggles. An excellent game. **G R H**

Touchline
Title. *Interceptor* ***Machine*** *Amiga.* ***Supplier*** *Electronic Arts 11-49 Station Road Langley Berks SL3 8YN* ***Tel*** *0753 49442* ***Price*** *£24.95*

Jack in the Box!

A handy utility which can be used by Basic or machine code programmers

By S. Scott

The Box utility program provides four main functions to allow powerful handling of screens.

Firstly, a PRINT routine is provided This is not necessary for machine code programmers as the kernal plot routine at $FFF0 can be used To position the cursor from Basic enter

SYS 52797,X Y

X must be in the range 0-39 and Y in the range 0-24

The second routine is called CONFIG This is a special routine that will allow the user to set up the utilities as required To call the CONFIG routine from Basic enter

SYS 52480,A,B,C,D,E F

A	Border colour
B	Screen colour
C	Ink colour
D	Input ink colour
E	Cursor colour
F	ASCii code of cursor e g ASC(" ") or 39

Calling the Config routine in machine code is slightly more complex The parameters A to F must be set up by placing the required values in the locations below This is done using LDA and STA in machine code

A	$D020	this is the standard border colour
B	$D021	screen colour
C	$0286	–cursor colour
D	-$CF68	input colour
E	$CF69	cursor colour
F	$CF6A	the cursor type

To call the Config routine enter JSR $CD00

Routine three is an input routine The main advantage that this has over the standard Commodore input statement is that numeric input is masked Only numbers are allowed in numeric input, letters and symbols are ignored

The cursor type and colour are pre-set by the config routine (section 2) For basic users, the input routine is called by the following statement

SYS 52814,TYPE,DIGITS

Type is a pasameter This shows the type of input 1 is used for numeric and any other value for alpha

Digits simply indicate the number of characters in the string This must be in a range of 1 to 25

NB the input data is stored at location $CF40 or 53056 decimal To read back the data the following code may be used

For numeric values

```
10 SYS 52814,1,10
20 A$=""
30 FOR L=0 TO 9
40 A$-A$+CHR$(PEEK(L+53056))
50 NEXT L
60 A-VAL(A$)
70 PRINT"NUMBER INPUT",A
```

For strings

```
10 SYS 52814,0,10
20 A$-""
30 FOR L-0 TO 9
40 A$-A$+CHR$(PEEK(L+53056))
50 NEXT L
60 PRINT"STRING INPUT ",A$
```

For machine code programmers, ensure that config has been set up Set the X register to the number of digits and set location $CF5E to the required value(0 or 1) Now call the routine at $CE57 with a JSR statement The input data is returned in location $CF40 as above

The final routine is called Box It was created to allow multi-size rectangles to be drawn with ease and speed The routine works by clearing the required area with spaces and drawing a box. The boxes give much enhancement to menus and the general display

To draw a box in Basic ensure the config routine has been called and then enter

SYS 52517,A B C,D,E,F,G H,

The parameters are

A the start X co-ordinate
B finish X
C start Y
D finish Y
E and F these values are used to specify additional lines The lines are displayed horizontally inline with the top and bottom lines The values for E and F should fall between C and D
G this is the colour of the box in the range 0 15
H the parameter allows the boxes to be drawn in reverse(1) or not(any other value)

An example box might be

SYS52517 10 30 5,14,7,12,1,1

Machine code programmers may use boxes by ensuring that config has been called and then setting the following locations to the required values

A	$CF5F	Start X
B	$CF60	Finish X
C	$CF61	Start Y
D	$CF62	Finish Y
E	$CF63	Line 1
F	$CF64	Line 2
G	$CF65	Colour of box
H	X-register	Reverse flag

When the parameters have been set execute the routine at $C057 with JSR $C057

Program Notes

The box routine has been kept compact to allow maximum memory usage by the programmer Therefore, parameters are not fully checked for valid entries and invalid or high values may cause corruption of your data!

To make the box program even easier to use, the following basic lines can be adopted

```
100 F=F+1
110 IFF-1THENLOAD"BOX UTILS"
     8 1
120 PRINT"8"
130 CO 52480   RFM CONFIG
140 BO-52517   REM BOX
150 AT 52797   REM PRINT AT
160 IN-52814   REM INPUT
               ROUTINE
```

See listings on page 61

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C16/Plus/4 owners -
full of invaluable
programs for both
serious and family
entertainment

On sale 7th October

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It's three o clock in the morning You sit at the computer keyboard having just finished a marathon typing session entering one of the superb programs from *Your Commodore* Your fingers reach for the keyboard and press the letters R U and N You press RETURN sit back and nothing happens

Everyone has probably faced this problem When it does happen it's a matter of spending hours searching through the program for any typing mistakes No matter how long you look or how many people help you you can usually guarantee that at least one little bug slips through unnoticed

The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6 00 for disk and £4 00 for cassette None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine Should you not have the magazine then back issues are available from the following address

INFONET LTD 5 River Park Estate Berkhamsted Herts
HP4 1HL
Tel (04427) 76661

Please contact this address for prices and availability

The Disk

Programs on the disk will also be supplied as totally working versions i e when possible we will not use Basic Loaders thus making use of the programs much easier Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes However programs for these machines will be available on the disk

What programs are available?

At the top of each article you will find a strap containing the article type C64 Program etc So that you can see which programs are available on which format you will also find a couple of symbols after this strap The symbols have the following meaning

📼

This symbol means that the program is available on cassette

💾

These programs are available on disk

Please Note

Since the programs supplied on cassette are total working versions of the program we do not put disk only programs on tape There is no sense in placing a program that expects to be reading from disk on to tape

MAY 1988

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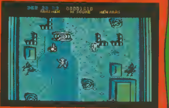
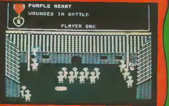
FERNANDEZ MUST DIE





I honestly thought we'd left this kind of gratuitous violence safely behind us – obviously I was wrong (a hard thing for a journalist to admit). Alright, Commando was good fun for a while, but it's been well and truly done to death (no pun intended). The scenario is totally predictable – fight your way up the screen shooting everything and everybody in your way to assassinate mad despotic General Fernandez and free the state of Diablo from his tyrannical rein.

Fernandez Must Die was written by none other than the legendary Tony 'Ratt' Crowther and David 'Bi' Bishop – obviously on the make — their way to the poorhouse! If you read this Tony, I hope you're ashamed of yourself!

Back to the game – the action takes place on a vertically scrolling map, viewed from the air. From time to time, planes fly over dropping bombs, supplies and enemy soldiers. These you should avoid, collect and shoot respectively. Abandoned jeeps abound, affording you a small measure of protection as well as getting you quickly from A to B. Your soldier is armed with a machine gun and hand grenades, and can make use of the Jeep's cannon if you have any shells (collect some along the way) to blow holes in the walls of the compounds – these can then be searched for hidden gold, prisoners, supplies, etc; before blowing them up. There are eight enemy bases, blowing them all up wins you the game, but should you fail you could be awarded a medal or two (posthumously).

The music is not brilliant, not even tolerable – 'unbearable' might come closer. Sound effects during the game are the predictable bangs and crashes, nothing particularly noteworthy.

This has been a difficult review to write, having absolutely nothing good to say about it. At the same time, some of you are going to buy this game no matter what I think. So if you like mindless violence, Fernandez Must Die is the game for you.

F.R.

Touchline:
Product: Fernandez Must Die Supplier: Image Works, Headway House, 66-73 Shoe Lane, London EC4P 4AP. Price: £9.99 (tape), £12.99 (disk) Machine: C64/128.

First Steps

By Norman Doyle

For such small phrases, error messages take a lot of understanding

Error messages are actually devised to help rather than hinder progress This article completes our look at file problems and tackles the errors that can arise with calculations

NOT INPUT FILE

Occurrence: program error

Generated after an INPUT # or GET # command, this means that the file number refers to an output file In other words the file was opened as a write only file

NOT OUTPUT FILE

Occurrence: program error

Similar to the previous error, this appears when the wrong type of file is accessed by the PRINT command

The only solution for both of these problems is to first of all check that the command does describe the required action and that the file number is correct If everything checks out, then the file must be closed and re opened as the correct type

FILE DATA

Occurrence: program/file error

When numeric data is expected from a file read command but string data is returned instead, this is the error message that appears First of all check that the file is the right one and then alter the INPUT # or GET # command structure to handle the data correctly

For some obscure reason, the C64 manual refers to this as the BAD DATA error message

MISSING FILE NAME

Occurrence: user error

This only occurs when operating with a device number greater than three and is generated when a null string is given as the filename This can only be done by using the syntax LOAD "",8 On cassette this would be a valid filename and would load the first program file encountered The equivalent disk command is an asterisk or a colon followed by an asterisk

ILLEGAL DEVICE NUMBER

Occurrence: user error

There are only two device numbers which cause this error zero and three These correspond to the screen and the keyboard which cannot be saved to or loaded from. With sequential files the operating system is blind to device numbers and will apparently accept any syntaxially correct statement regardless.

Printers are not input devices but the operating system will still allow an attempt to load. Trying to save to a printer produces interesting results!

Legal device numbers range from zero to 255 but values less than 63, or between 128 and 191 generate a DEVICE NOT PRESENT error if the device is not connected. An attempt to access devices with any of the remaining values will be executed whether the device exists or not.

If a device number of 256 is used the error generated is ILLEGAL QUANTITY.

LOAD

Occurrence: operating system or user intervention

This indicates that a load has failed. The causes can be a faulty disk or tape, a permanent or temporary electrical fault or the pressing of the RUN/STOP key to abort a load.

The electrical fault may be as simple as a bad connection at the cassette port or a transient power spike. Spikes are caused by heavy load equipment such as central heating systems, cookers or fridges causing a feedback into the main. This usually causes the visual display to jump and a loud click is heard through the speaker.

Another cause can be misaligned tape heads. As time goes by, the playback/record head can move slightly and the tape signal misses the read head slightly. This results in a loss of 'volume' which the computer can only tolerate to a certain degree. Once the signal becomes so quiet that this threshold is reached, the tape may start reading until natural tape movement pulls the signal down below the cassette recorders threshold of hearing'.

Alternatively, the drive band in the cassette may be worn out. This causes the tape to vary in speed ruining the precise signal timing that the computer relies on to make sense of the data. Similarly, a motor fault would produce the same effect.

The solution to spikey mains signals is to unplug the offending equipment or to fit a smoothing mains filter socket for the computer equipment.

Alignment problems can be cured by a datasette doctor system which will help to diagnose and possibly correct the fault.

Disk faults result from similar causes to cassette faults but correction of alignment or speed problems is more difficult to solve. Disk drive alignment kits are available but they're more difficult to use. Given that the disk is faulty anyway, one may be worth a try. Care must be taken however because the drive plugs directly into the mains and a 240V shock could be at the least painful, at worst fatal.

VERIFY

Occurrence: operating system or user intervention

A verify error usually occurs because the disk or tape program is not the same as the one in the computer's memory. If this is definitely not the case, the device has one of the faults outlined under LOAD errors.

This completes the catalogue of cassette based errors but there are plenty of problems which can be experienced with disk drives. The C128, C16 and Plus/4 computers all have special handling systems to report these faults but C64 users will have to rely on the flashing red LED warning light on the drive. A cartridge or a disk operating system, such as the one supplied on the TEST/DEMO disk, can correct this problem.

All of the remaining errors in the C64's repertoire are programming errors. The specialised C128, C16 and Plus 4 errors will be covered in a later article.

Mathematical Errors

Mathematical operations follow very strict rules, all of which cannot be detected by the operating system. Use of statements such as 4*5+1 are valid when the required answer is 21 but invalid when the programmer means that four is to be multiplied by the result of five plus one. This should be correctly written as 4*(5+1). Such undetectable programmer errors are not the concern of the computer's operating system and care in the use of brackets is an essential skill to master.

ILLEGAL QUANTITY

This occurs when a number is used which goes beyond the allowable range for an integer variable or exceeds the 255 range of file numbers, device numbers and other such values.

The allowable range for integers is -32768 to +32767 inclusive. If a calculation is expected to exceed these limits it is best to use the more usual floating point method (A rather than A%).

OVERFLOW

An overflow error only occurs when the result of a floating point calculation exceeds plus or minus 1.7014118345E+38.

No errors are generated with negative exponential (E) values which exceed 2.93873588E-39. This is because lower decimal values represented in this way are very small indeed, having 38 zeros between the decimal point and the string of numbers preceeding the E value. Unfortunately, exceeding this value results in the variable becoming zero, so calculations should be kept well within the limit to ensure maximum accuracy.

DIVISION BY ZERO

Although dividing by zero is not permitted, dividing zero by another number is allowed but gives a value of zero.

FORMULA TOO COMPLEX

This can occur under numerous circumstances but basically means that the computer cannot cope with the mathematical formula as it is presented.

Correction involves breaking the calculation down into easily assimilated sub-calculations or to use fewer brackets if at all possible.

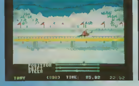
UNDEF'D FUNCTION

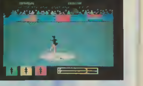
All FN functions must be defined before they are used. This may sound like commoosense but it can be easily done when a program is created in modular form using subroutines.

The way to avoid the error is to define all functions within the first few lines of every program. If a function is necessary at line 1000 of a program go back and add a line as near to the beginning as possible to set up the FN formula.

Next month we'll be covering errors associated with GET and INPUT including problems posed by mixing strings and numerical data. Th

The Games Winter Edition





First there was Summer Games, then its sequel Summer Games II which were quickly followed by Winter World and California Games Now just when you thought it was safe to pick up your joystick out comes The Games Winter Edition

Seven more events await joystick athletes in the first of the many games set to jump on the Olympic bandwagon but why is the Winter Edition released now in the Summer when you just know there's a Summer Edition coming in the winter?

These new "games" games are as result of Epyx's success in capturing a Olympic licence and the Winter Edition includes a combination of snow, skis skates and ice which will prove irresitable to those aspiring to the greatness of top athletes such as Eddie "the Eagle" Edwards

Many of the seven events in the Winter Edition appeared in Winter Games but are now more involved games demanding more than a sequence of joystick moves

As with the previous games, up to eight players can compete for gold, silver and bronze medals and to set new world records You can also practise any event or compete in one or more

The luge is the first event and hurling yourself down a track on a small piece of wood seems the ideal way to end the contest not start it But you must steer your luge down one of four packed snow tracks faster than anyone else by steering it down the middle of straights and riding corners as much as you can without clipping the edges which will cost you valuable seconds

Cross Country skiing also gives you a choice of courses that range from one to five kilometres and is basically the Winter Games Biathlon without the shooting and is the most disappointing of all events as a simple left Right rhythm will ensure a good time

The ice skating is far more involved than its Winter games equivalents as now you must choose your music and plan your program of moves before performing it in the Olympic arena A selection of jazz, rock and pop ensure a mixture of beats to plan your double axels, spins and falls to Then in the performance you have to perform the right move at the right time in the music to score maximum points

For true Eddie Edwards action you should try the Ski Jump with its new jumper perspective of the slide down the slope before you hopefully soar into the air for a medal leaping jump or plummet and land in a heap in the snow

The slalom course is just as treacherous as you must ski between the flags Timing is vital but the inconsistent spacing of the flags means a simple rhythm just won't work

Speed skating seems like an obvious event to include and many were surprised that it was left out of the original Winter Games but now it's back for those who want head to head racing action In this event beating a computer pacer isn't quite as satisfying as crossing the finishing line while your human opponent is face down in the ice

The final event is for the extroverts of the skiing world as TV cameras line the route of the downhill. The course is mapped out with flags that you must steer between to stay on your skis but when you come in range of the cameras you can show off with a few flips and jumps Naturally it's the one with the fastest time that will take the gold but it helps to get the crowd on your side

The medals are presented to the winners in true Olympic fashion with the first three on pedestals, the gold medal winners national anthem playing as the flags are unfurled

More stirring stuff from Epyx

Touchline **T H**

Title *The Games the Winter Edition.* ***Supplier*** *Epyx (US Gold), Units 2/3, Holford Way, Holford, Birmingham B6 7AX* ***Tel:*** *021-356 3388* ***Machine*** *C64* ***Price*** *£9 95*

Listings

Get it right first time with our deluxe program system for the C64

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code or mnemonic is always contained in square brackets and you'll soon learn to decipher their meanings.

For example [SA] would mean type in a Shifted A or an ace of spades in layman's terms and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as

[CTRL N, DOWN2 LEFT5,BLUE F3 C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string, the symbol for pi. This may appear when its value is needed in a calculation so this may look something like

CC=2*[PI]*R

Ignore the square brackets and just type in a shifted upward pointing arrow (ie the pi symbol).

PROGRAM: SYNTAX CHECKER

```
5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10   LN=70   SA=49152
20 FOR L=0 TO BL CX=0 FOR D=0 TO
 15
30 READ A IF A>255THENPRINT"NUMB
ER TO LARGE" LN+(L*10):STOP
40 CX=CX+A POKE SA+L*16+D A NEXT
 D
50 READ A IF A<>CX THENPRINT"ERR
OR IN LINE" LN+(L*10) STOP
60 NEXT L SYS 49152 NEW
70 DATA 173 5 3 201 169 208 31 1
20 169 8 141 32 208 141 33 208 1
847
80 DATA 169 7 141 134 2 169 13 3
2 210 255 169 84 141 4 3 169 168
2
90 DATA 192 141 5 3,88 96 120 16
5 124 141 4 3 169 165 141 5 1588

100 DATA 3 165 14 141 134 2 141
32 208 169 8 141 33 208 88 96 16
85
110 DATA 32 124 165 78 138 72 15
2 72 162 0 165 20 133 254 165 21
 1747
120 DATA 84 101 254 133 254 165
0 2 240 18 65 254 133 254 232 18
9 2346
130 DATA 0 2 240 9 24 101 254 13
3 254 232 208 233 168 1 141 134
2134
140 DATA 2 165 254 74 74 74 74 3
2 166 162 30 210 255 165 254 41
2054
150 DATA 15 32 166 162 30 210 25
5 169 13 32 210 255 169 13 32 21
0 1595
160 DATA 255 168 7 141 134 2 104
 168 104 170 104 96 24 105 48 80
1 1832
170 DATA 56 16 1 56 24,105 7 56
0 0 0 0 0 0 0 0 403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one. Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time.

Mnemonic	Symbol	Keypress
[RIGHT]	▨	CRSR left/right
[LEFT]	▨	SHIFT & CRSR left/right
[DOWN]	▨	CRSR up/down
[UP]	▨	SHIFT & CRSR up/down
[F1]	▨	f1 key
[F2]	▨	SHIFT & f1 key
[F3]	▨	f3 key
[F4]	▨	SHIFT & f3 key
[F5]	▨	f5 key
[F6]	▨	SHIFT & f5 key
[F7]	▨	f7 key
[F8]	▨	SHIFT & f7 key
[HOME]	▨	CLR/HOME
[CLR]	▨	SHIFT & CLR/HOME
[RVSON]	▨	CTRL & 9
[RVSOFF]	▨	CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]	▨	CTRL & 1
[WHITE]	▨	CTRL & 2
[RED]	▨	CTRL & 3
[CYAN]	▨	CTRL & 4
[PURPLE]	▨	CTRL & 5
[GREEN]	▨	CTRL & 6
[BLUE]	▨	CTRL & 7
[YELLOW]	▨	CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

Listings

SPRITE LIBRARY

```
PROGRAM  MULIIALPH DISPLAY

65  10 REM****************************
    ****
31  20 REM* SPRITE LIBRARY DISPL
    AY *
81  30 REM*        MULIIALPH
    *
C8  40 REM****************************
    ****
5F  50 POKESS 0 POKES6 40 X=X+1
    IFX=1THENLOAD"MULTIALPH" 8 1
E0  60 P0=70 P1=150 P2=110 P3=15
    0 P4=100 P5=150 P6=248 P7=15
    0 S=160 E=198 D=250
76  70 V=53248 PRINT"[CLR WHITE
    DOWN25 RIGHT8 RVSON]F7 TO ST
    OP ANIMATION"
84  80 POKEV+21 15 POKEV+23,10 P
    OKEV+28 15 POKEV+25 12 POKEV
    +32 3 POKEV+33 3
63  90 POKEV+37 0 POKEV+38 15 PO
    KEV+39,2 POKEV+40 2 POKEV+41
    ,2 POKEV+42 2 POKEV P0
87  100 POKEV+1 P1 POKEV+2 P2 PO
    KEV+3 P3 POKEV+4 P4 POKEV+5
    P5 POKEV+6 P5 POKEV+7,P7
1A  110 INPUT"[HOME DOWN]START S
    PRITE" S INPUT"END SPRITE" E
     INPUT DELAY" D
17  120 FORSP=SIDE FORT=0TOD NEX
    T PRINT"[HOME]"TAB(23) SPRIT
    E NO =" SP POKE2040 SP
57  130 POKE2041 SP POKE2042 SP
    POKE2043,SP NEXT GETK$ IFK$=
     [F7]"THEN110
34  140 GOTO120
```

```
PROGRAM  MULTIALPH DATA

AF  10 REM****************************
    *
2E  20 REM*    SPRIIE  LIBRARY
    *
30  30 REM*    --          ---
    *
5F  40 REM*  MULIIALPH SPRITES
    *
_E  50 REM*  BASIC DATA LOADER
    *
35  60 REM* SPRIIES DESIGNED BY
    *
2E  70 REM*        MIKE BENN
    *
C5  80 REM****************************
    *
DD  90 AL=255   LN=190   SA=1024
    0
65  100 FOR L=0 TO AL CX=0 FOR D
    =0 TO 15
4P  110 READ A IF A>255THENPRINT
    "NUMBER TO LARGE" LN+(L*10)
    STOP
5B  120 CX=CX+A POKE SA+L*16+D A
     NEXT D
D8  130 READ A IF A><CX THENPRIN
    T ERROR IN LINE" LN+(L*10) S
    TOP
37  140 NEXTL POKE43 0 POKE44,40
     POKE45 0 POKE46 56
85  150 SAVE MULTIALPH" 8 1 END
EF  160 REM***************************
    **********
3B  170 REM TAPE USERS WILL NEED
     TO CHANGE          DEVICE N
    UMBER FROM 8 TO 1
F8  180 REM***************************
    **********
4F  190 DATA 0,0 0,0 0,0 0 42 0
    0 170 128 2,166 160 6 674
6C  200 DATA 145 160 6 129 160 6
     129 160 6 129 160 6,170 160
     6 170 1782
AA  210 DATA 160 6 145 160 6 129
     160 6,129 160 6 129 160 6 1
    29 160 1655
AD  220 DATA 6 129 160 10 162 16
    0 26 166 166 21 69 80 0 0 0
    190,1355
52  230 DATA 0 0 0 0 0,0 10 170
    0 26,170 120 22 150 160 6 84
    2
62  240 DATA 129,160,6 129,160 6
     129 160 6 129 160,6 170 144
    ,6 170 1670
6B  250 DATA 64 6 145 128 0 129
    160 6 129 160 6 129 160 6 12
    9 160 1527
8E  260 DATA 6 129 160 10 170 14
    4 26 170,64 21 85 0 0 0 0 25
    5 1240
C3  270 DATA 0 0,0 0 0 0 0 42 32
     0 170 95 2 166 160 6 674
D5  280 DATA 145,160 6 129 160 6
     129 160 6 129 64 6 128 0 6
    128 1362
AE  290 DATA 0 6 128 0 6 129 160
     6 129 160 6 129 160 6 129 1
    60 1314
A2  300 DATA 6 161 160 6 170 144
     1 106 64 0 85 0 0 0 0 144 1
    046
CF  310 DATA 0 0 0 0 0 0 10 170
    0 26 170 128 22 150 160 6 84
    2
A8  320 DATA 129 160 6 128 160 6
     129 160 6 128 160,6 129 160
     6,129 1604
AY  330 DATA 160 6 129 160 6 128
    ,160 6 129 160 6 129 160 6 1
    29 160 1635
70  340 DATA 6 129 160 10 170 14
    4 26 170 64 21 85 0 0 0 0 20
    7 1192
C1  350 DATA 0 0,0,0 0 0 10 170
    160 26 170 160 22 145 160 6
    1033
C8  360 DATA 129 160 6 129 64 6
    128 0 6 128,0 6 170 128 6 17
    0,1236
8F  370 DATA 128 6 145 0,6 128 0
     6 128 0 6 128 0 6 128 160 9
    78
AD  380 DATA 6 129 160 10 170 16
    0 26 170 160 21 85 64 0 0 0
    127 1280
D8  390 DATA 0 0 0 0 0 0 10 170
    160 26 170 160 22,145 160 6
    1033
D8  400 DATA 129 160 6 129 64 6
    128 0 8 128 0 6 170 128,6 17
    0 1236
E8  410 DATA 128 6 145 0 0 128 0
    ,6 128,0,6 128 0 6 128 0 815
12  420 DATA 6 128 0 10 160 0 26
    ,160 0 21 64 0 0,0 0,127 702
E3  430 DATA 0 0 0 0 0 0 2 42 32
    ,0 170 95 2 166 160 6 674
63  440 DATA 145 160 6 129 160,6
     129 64,6 128,0 6 128 0 6 12
    8 1201
37  450 DATA 0 6 130 160 6 134 1
    60 6 133 160 6 129 160 6 129
     160 1501
4P  460 DATA 6 161 160 5 170 144
    ,1 106 64 0 85 0 0 0 0 2 904
53  470 DATA 0 0 0 0 0 0 10 162
    168 26,166 165 22 133 160 6,
    1021
58  480 DATA 129 160 6 129 160 6
     129 160 6 129 150 6 170 160
     6 170 1686
F1  490 DATA 160 6 145 160 6 129
     160 6 129 160 6 128 160 6 1
    29 160 1655
E7  500 DATA 6 129 150 10 162 16
    0 26 166 166 21 69 80 0 0 0
    95 1260
F5  510 DATA 0 0 0 0 0 0 0 42 10
    0 0 106 128 0 90 0,0 494
D7  520 DATA 26 0 0 26 0 0,26 0
    0 26 0 0 26 0 0 26 156
4F  530 DATA 0 0 26 0 0 26 0 0 2
    6 0 0 26 0,0 26 0 130
DF  540 DATA 0 26 0 0 105 128 0
    106 128 0 85 0 0 0 0 84 663
88  550 DATA 0 0 0 0,0 0 0 10 16
    0 0,26 160 0 22 128 0 506
99  560 DATA 6 128 0 6 128 0 6 1
    28 0 6 128 0 5 128 0 6 576
82  570 DATA 128,0 6 128 0 6 128
    ,0 6 128 0 6 128,10 6 128 80
    8
DD  580 DATA 26 6 128 22 170 128
     1 170 0 1 84 0 0 0 0 232 86
    8
```

```
99  590 DATA 0 0 0 0,0,0 10 160
    160 28,162 160 22,130,160 6
    596
66  600 DATA 130 144,6,130,64 6
    170 0 6 169 0 6,168,0,6 164
    1106
35  610 DATA 0 6 168 0 0 170,0 6
    ,154,0,6 154 128 6 154 160 1
    110
15  620 DATA 6,150,160,10,166,16
    0,26 166,166,21,65,80,0,0,0,
    22 1212
F3  630 DATA 0 0 0,0 0 0 10,168
    0 26 160 0 22,120 0 6 512
F1  640 DATA 128 0 6 128,0,6,126
     0 6 128 0 6 128 0 6 128 798
EA  650 DATA 0 6 128 0 6 128 0 6
     128,0,6,128 160 6 129 160 9
    91
35  660 DATA 6 129 160 10 170 16
    0 26 170 160 21 65 64 0 0 0
    253 1414
28  670 DATA 0 0,0 0,0 0 42 0 42
    ,106 128 170 90,128,168 26 9
    00
E0  680 DATA 162 160 26,162,160
    26 106 104 26 106,104,26 08
    104,28 24 1420
59  690 DATA 104 26 20 104 26 0,
    104 26 0,104 26 0 104 26 0,1
    04 774
D9  700 DATA 26,0 104 42 128 170
    ,106 128 170 85 1 85 0 0 0 4
    6 1052
83  710 DATA 0 0 0 0 0 0 42,2 16
    0 104 6 168 90 133 160 26,90
    1
EA  720 DATA 129 160 26 161 160
    26 161 160 26 161 160 26 169
     160 26,105 1816
22  730 DATA 160 26 105 160 26 9
    0,160 26 26 160 26 26 160 26
    ,22 160 1359
66  740 DATA 26 6 160 42,5 160 1
    06 1 160 84 1 64 0 0 0 190 1
    005
E9  750 DATA 0 0 0 0 0 0 0 42,0
    0 170 128 2 166 160 6 674
02  760 DATA 145 160 6 133 160 6
     129 160 6 129,160 6 129 160
    ,6 129,1628
CF  770 DATA 160 6 129 160 6 129
    ,160 6,129 160 6 129 160 6 1
    29 160 1625
F0  780 DATA 6,162 160 5,170 144
    ,1 108,84 0,85 0 0 0 0 72 97
    5
05  790 DATA 0 0 0 0 0 0 10 170,
    0,26,170,128 22 150 160 6 64
    2
F5  800 DATA 129,160,6 129,160 6
    ,129 160 6 129 160 6,170 144
     6 170 1670
E3  810 DATA 64 6 148 0 6 128 0
    6 128 0 6 128 0 6 128 0 754
24  820 DATA 6 128 0 10,160 0 26
    ,150 0 21,84 0 0 0 0 122,697
24  830 DATA 0 0 0 0 0 0 0 42 0
    0 170,128 2 166 160,6,674
5A  840 DATA 145 160 6 129 160 6
    ,129,160,6 129,160 6 129 160
    ,6 129 1620
5E  850 DATA 160 6 129,160 6 130
    ,160,6,154 160 6 164 160 6,1
    50 160 1715
83  860 DATA 6,166 160 5 170,160
     1 106 104 0,85,104 0 0 80 1
    50 1313
35  870 DATA 0 0 0 0 0 0 10 170
    0 26 170,128 22 150,160,6 64
    2
25  880 DATA 129 160,6,129 160 6
    ,129,160,6,129,160,6,170 144
    ,6,170,1670
A8  890 DATA 64,6,168,0 6 170 0
    6 154 128,6,150 128 0,134 12
    0 1254
5C  900 DATA 6 134 128 10 165 16
    0 26 181 160 21,65,64,0 0 0
    193,1293
81  910 DATA 0 0,0,0,0,0,0,42 32
    ,0 170 96 2 168 160 0 674
95  920 DATA 145,160 6,129 160 6
    ,129 160 6,129 64 6 160 0,1,
    104 1360
C0  930 DATA 0 0 80 0 0 22 126 0
    ,5,160,6 129 160 6 129 160 9
    55
81  940 DATA 6 162 160 6 170 144
     6 108 64 5 85 0 0 0 0 151 1
    065
32  950 DATA 0,0 0 0 0 0 10 170
    160 26,170,160 25 105 96,28
    942
AE  960 DATA 104,64 0,104 0 0 10
    4 0 0 104 0,0 104 0 0 104 66
    8
98  970 DATA 0 0,104 0 0 104 0 0
     104,0 0 104,0 0 104 0 520
38  980 DATA 0 104 0 1 170 0 1 1
    70 0 1,84 0 0 0 0 206 738
74  990 DATA 0 0 0 0 0 0 0 0 0 1
    0 162 168 26 166 165,22,722
48  1000 DATA 133 160 6 129 160,
    6,129 160 6,129 160 6 129 16
    0 6 129 1609
DF  1010 DATA 160,6 129,160 6 12
    9,160 6 129 160 6 129 150 6
    129 160 1535
8E  1020 DATA 6,162,160 5 170 14
    4 1 106 64,0,85,0 0 0 0 151
    1054
31  1030 DATA 0 0,0,0 0 0 0 0 0
    10 0 40 26,0,104 26 206
3D  1040 DATA 128 160 22 129 160
     6 129,160 5 129,128 1,162 1
    28,1,166 1622
A4  1050 DATA 128 1 166 128 1 16
    6,128 1 102,0,0,192 0 0 105
    0,1025
E5  1060 DATA 0 106 0 0 105 0 0
    80 0,0,16,0 0 0,0 145,485
81  1070 DATA 0 0 0,0,0 0 42 128
    ,170 106,129 170 90 1 104 26
    ,586
0D  1080 DATA 8,104 26 24 104 26
    ,42,104 26 106 104 26 106 10
    4 26 166,1102
EE  1090 DATA 160,26 166 160 26
    133 160 26 128 160 26 128 16
    0 26 1 104 1632
E6  1100 DATA 25 0,104,28,0 80 2
    4 0 24,10 0 15 0 0,0 7 321
F8  1110 DATA 0 0 0 0 0 0 2 128
    160,0 129 160 6 129 160 6 88
    6
87  1120 DATA 166 128 5 166 128
    1 166 128,1 106 0 0,106 0 0
    106 1207
08  1130 DATA 0 0 106 2 2 102 0
    2 166 128,0 166,128 2 166 16
    0,1124
F3  1140 DATA 6 145 160 6 129 16
    0 6 129,160 5 1 64,0 0 0 52
    1027
D9  1150 DATA 0 0 0 0 0 0 12 0 1
    60 26,132,160,26 134,160 22
    828
E5  1160 DATA 134,128 6,134,128
    6 134 128 6,134 128 6 134 0,
    1,134,1340
E7  1170 DATA 0 1,170,0 1 170 0
    1 105 0 0 104,0 0 104 0 657
45  1180 DATA 0 104 0 0 104 0 0
    104,0,0,60 0,0,0 0 192 584
04  1190 DATA 0 0 0 0 0 0 2 170
    160 6 170 160 6 149 160 6 59
    5
03  1200 DATA 129 160 5 1 160 0
    1,160 0 2 128 0 10 0 0 40 79
    6
66  1210 DATA 0 8,160 0,2,128 0
    6 128 0 6,128 0 6,128 160 85
    2
4A  1220 DATA 6 129 160 6 170 16
    0,6 170 160 5 85 64 0 0 0 10
    6,1307
53  1230 DATA 0 0 0 0,0 0,0 42 0
    ,0,170 128 2 166,160,6,674
3C  1240 DATA 145 160 6 133 160
    6,161,160 6 169,160,6,169 16
    0,6 154 1765
44  1250 DATA 160 6 154 160 6,15
    0,160 5 134 160 6,133 160 6
    129 160 1690
45  1260 DATA 0 162 160 5 170,14
    4,1,106,64,0 85 0 0 0 5 81
    2
ED  1270 DATA 0,0 0 0 0 0 0 10,0
    ,0 42 0 0 106 0,0 156
89  1280 DATA 106 0,0 90 0 0,26
    0 0 26 0 0 26 0 0 26 300
A6  1290 DATA 0,0,26 0,0 26 0 0
    26,0 0 26 0 0 26 0,130
88  1300 DATA 0 42 128 0 106,128
    ,0 106,128 0 85,0,0,0 0 89 0
    12
37  1310 DATA 0 0 0 0 0 0 0 0 170
    128 2 170 160 6 170 160,6 97
    2
E1  1320 DATA 161,160,6 129 160
    5,1,160 0 2 160,0,10,160 0 4
    2 1156
27  1330 DATA 128 0 170 0 0 160
    0,2 160,0 6,128,160 6,129 16
    0 1217
27  1340 DATA 6 170,160,6,170 16
    0 6 170,160,5,85 64 0 0,0 23
    4 1386
3F  1350 DATA 0 0 0 0 0 0 2 170
    160 6,170 160 6 150 160 6 59
    0
9C  1360 DATA 130,128 5 74,128 0
    ,10,0,0 42 0 0 170 128 1 170
     986
CA  1370 DATA 128,1,86 160,0 1 1
    60 0 1 160 2 129 160 6,130 1
    60 1204
56  1380 DATA 6 170,128,5,170 12
    8 1 106 0 0 85 0 0 0 0 252 1
    051
70  1390 DATA 0 0 0 0 0 0,0 10 1
    28 0 26 128 0 42 128 0,462
70  1400 DATA 106 128 0 170 128
    1 166 128 1 166 128 2 166 12
    8 6 150 1574
93  1410 DATA 128 6 134 128 10 1
    72 160 26,170 160 26 170 166
    ,21 68 144 1723
C7  1420 DATA 0 10 160 0 26 160
    0 26,160 0 21 64 0 0 0 159 7
    56
80  1430 DATA 0 0 0 0 0 0 2 170
    160 6 170 168,6 170 160 6 10
    10
34  1440 DATA 145 160 6 129 160
    6 129 64 6 160 0 5 170,0,1 9
    0 1243
7E  1450 DATA 128 0 22 160 0 5 1
    60,0 1,160 6 129 160 6 130 1
    60 1227
21  1460 DATA 6,170,160 5 170 12
    8,1,106 0,0,85 0 0 0 0,19,85
    0
AE  1470 DATA 0,0,0 0,0 0 0 42 0
     0,170,128,2 166,160 6 674
```

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75   1480 DATA 145,160,6,129,160,
     6,129,64,6,128,0,6,170,0,6,1
     70,1285
42   1490 DATA 128,6,150,160,6,12
     9,160,6,129,160,6,129,160,6,
     162,160,1657
63   1500 DATA 6,170,160,5,170,12
     0,1,106,0,0,85,0,0,0,0,133,5
     40
0D   1510 DATA 0,0,0,0,0,0,2,170,
     160,6,170,162,6,170,160,6,10
     12
5C   1520 DATA 149,160,6,129,160,
     5,74,170,0,26,0,0,26,0,0,40,
     935
5A   1530 DATA 0,0,104,0,0,104,0,
     0,160,0,1,160,0,1,160,0,650
E6   1540 DATA 2,160,0,6,160,0,6,
     160,0,5,80,0,0,0,0,58,701
6D   1550 DATA 0,0,0,0,0,0,0,42,0,
     0,170,128,2,166,160,6,674
30   1560 DATA 149,160,6,133,160,
     6,129,160,6,162,160,5,170,12
     8,1,106,1641
A2   1570 DATA 0,0,166,128,2,149,
     128,2,133,160,6,129,160,6,12
     9,160,1450
42   1580 DATA 6,162,160,5,170,14
     4,1,106,64,0,85,0,0,0,0,36,5
     39
C8   1590 DATA 0,0,0,0,0,0,0,42,0,
     0,170,128,2,170,160,6,678
81   1600 DATA 166,150,6,149,160,
     6,133,160,6,129,160,6,161,16
     0,5,170,1737
84   1610 DATA 160,1,106,160,0,85,
     160,0,0,162,2,128,160,6,128
     ,160,1416
56   1620 DATA 6,162,160,5,170,12
     0,1,106,0,0,85,0,0,0,0,251,1
     074
5E   1630 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,160,0,2,170
DF   1640 DATA 170,0,10,58,128,26
     ,22,128,26,6,128,0,166,128,2
     ,170,1194
2D   1650 DATA 128,10,170,128,26,
     154,128,26,58,128,26,22,128,
     26,6,128,1324
78   1660 DATA 26,130,128,22,170,
     160,5,170,160,1,85,64,0,0,0,
     144,1273
5F   1670 DATA 0,0,0,0,0,0,10,160,
     0,26,160,0,22,128,0,6,512
DC   1680 DATA 128,0,6,128,0,6,12
     8,0,6,128,0,6,130,0,6,170,85
     0
8F   1690 DATA 128,6,166,160,6,14
     9,160,6,129,160,6,129,160,6,
     129,160,1668
92   1700 DATA 6,162,160,10,170,1
     28,26,154,0,21,65,0,0,0,0,22
     ,526
73   1710 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,32,0,32
DD   1720 DATA 42,86,0,170,160,2,
     166,160,6,149,160,6,133,160,
     6,129,1545
A2   1730 DATA 64,6,128,0,6,128,0
     ,6,128,0,6,128,160,6,129,160
     ,1055
1A   1740 DATA 6,162,160,5,170,14
     9,1,106,64,0,85,0,0,0,0,133
     1042
FC   1750 DATA 0,0,0,0,0,0,0,10,1
     60,0,26,160,0,22,128,0,586
3C   1760 DATA 6,128,0,6,128,0,6,
     128,0,6,128,0,166,128,2,170,
     1082
5C   1770 DATA 128,10,154,128,26,
     86,128,26,86,128,26,6,128,26
     ,10,128,1224
07   1780 DATA 26,130,128,22,170,
     160,5,166,160,1,81,64,0,0,0,
     20,1141
8E   1790 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,42,0,0,42
24   1800 DATA 170,128,2,166,160,
     6,149,160,6,133,160,6,161,16
     0,6,162,1735
C9   1810 DATA 160,6,170,160,6,17
     0,128,6,154,0,6,148,0,5,128,
     160,1408
BE   1820 DATA 6,160,160,5,170,12
     0,1,106,0,0,84,0,0,0,0,0,820
4D   1830 DATA 0,0,0,0,0,0,0,10,1
     28,0,42,160,0,165,160,1,666
48   1840 DATA 161,64,1,162,0,1,1
     60,0,1,160,0,1,160,0,2,170,1
     041
DE   1850 DATA 0,5,170,0,5,164,0,
     1,160,0,1,160,0,1,160,0,828
DA   1860 DATA 1,160,0,2,168,0,6,
     160,0,5,80,0,0,0,0,155,785
64   1870 DATA 0,0,0,0,0,0,0,0,0,
     0,42,0,0,170,128,2,342
35   1880 DATA 166,160,2,149,160,
     6,133,160,6,129,160,6,130,16
     0,6,162,1695
E8   1890 DATA 160,6,170,160,5,17
     0,160,1,105,160,0,85,160,2,1
     33,160,1637
8A   1900 DATA 6,150,160,5,170,12
     0,1,106,0,0,84,0,0,0,0,0,810
14   1910 DATA 0,0,0,0,0,0,10,160
     ,0,26,160,0,22,128,0,6,512
48   1920 DATA 128,0,6,128,0,6,12
     8,0,6,128,0,6,130,0,6,170,85
     0
59   1930 DATA 128,6,165,160,6,14
     9,160,6,133,160,6,129,160,6,
     129,160,1664
5A   1940 DATA 6,129,160,10,162,1
     60,26,166,160,21,85,64,0,0,0
      245,1426
24   1950 DATA 0,0,0,0,0,0,0,10,0
     ,0,26,0,0,20,0,0,56
35   1960 DATA 0,0,0,42,0,0,106,0
     ,0,58,0,0,26,0,0,26,250
7C   1970 DATA 0,0,28,0,0,26,0,0,
     26,0,0,26,0,0,26,0,130
2E   1980 DATA 0,26,0,0,42,128,0,
     106,128,0,85,64,0,0,0,168,74
     7
D5   1990 DATA 0,0,160,0,1,160,0,
     1,64,0,0,0,0,2,160,0,546
5A   2000 DATA 6,160,0,5,160,0,1,
     160,0,1,160,0,1,160,0,1,415
98   2010 DATA 160,0,1,160,0,1,15
     0,2,129,162,6,129,160,6,130,
     162,1364
66   2020 DATA 6,170,128,5,170,0,
     1,104,0,0,84,0,0,0,0,53,761
BC   2030 DATA 0,0,0,0,0,0,10,160
     ,0,26,160,0,22,128,0,6,512
58   2040 DATA 128,162,6,130,160,
     6,130,128,6,130,0,6,130,0,6,
     162,1310
83   2050 DATA 0,6,160,0,6,170,0,
     6,154,0,6,154,128,6,150,160,
     1114
58   2060 DATA 6,133,160,10,162,1
     60,26,166,160,21,85,84,0,0,0
     ,26,1155
E4   2070 DATA 0,0,0,0,0,0,0,0,42,0
     ,0,106,0,0,58,0,0,238
3D   2080 DATA 26,0,0,26,0,0,26,0,
     0,26,0,0,26,0,0,26,156
F5   2090 DATA 0,0,26,0,0,26,0,0,
     26,0,0,26,0,0,26,0,130
8D   2100 DATA 0,26,0,0,106,128,0
     ,106,128,0,85,0,0,0,0,131,71
     0
95   2110 DATA 0,0,0,0,0,0,0,0,0,0
     0,0,0,0,0,0,0,0
05   2120 DATA 0,0,0,0,0,10,128,0
     ,26,128,0,22,130,32,6,170,66
     0
48   2130 DATA 160,6,170,160,6,15
     4,104,6,154,104,6,154,104,6,
     154,104,1560
D9   2140 DATA 6,154,104,10,154,1
     06,26,154,106,21,21,84,0,0,0
     ,251,1197
FD   2150 DATA 0,0,0,0,0,0,0,0,0,0
     0,0,0,0,0,0,0,0
65   2160 DATA 0,0,0,0,0,0,0,0,2
     160,0,6,162,128,5,170,633
2E   2170 DATA 162,1,165,160,1,16
     5,160,1,161,160,1,161,160,1,
     161,160,1762
5E   2180 DATA 1,161,160,2,161,16
     0,6,161,168,5,65,80,0,0,0,15
     2,1330
C5   2190 DATA 0,0,0,0,0,0,0,0,0,0
     0,0,0,0,0,0,0,0
03   2200 DATA 0,0,0,0,0,0,42,0,0
     ,170,128,2,166,160,6,149,823
19   2210 DATA 160,6,133,160,6,12
     9,160,6,129,160,6,129,160,6,
     129,160,1639
51   2220 DATA 6,161,160,5,170,12
     8,1,106,0,0,84,0,0,0,0,62,80
     3
E0   2230 DATA 0,0,0,0,0,0,10,130
     ,0,26,170,128,22,166,160,6,8
     26
0A   2240 DATA 149,160,6,133,160,
     6,129,160,6,129,160,6,162,16
     0,6,170,1702
5C   2250 DATA 128,6,154,0,6,149,
     0,6,128,0,6,128,0,6,128,0,84
     5
3F   2260 DATA 6,128,0,10,160,0,2
     6,160,0,21,64,0,0,0,0,2,577
44   2270 DATA 0,0,0,0,0,0,0,162,
     160,2,170,160,10,154,128,26
     972
25   2280 DATA 86,128,26,22,128,2
     6,6,128,26,6,128,26,130,128
     22,170,1154
95   2290 DATA 128,5,166,128,1,86
     ,128,0,6,128,0,6,128,0,6,128
     ,1044
38   2300 DATA 0,6,128,0,10,160,0
     ,26,160,0,21,64,0,0,0,195,77
     0
5C   2310 DATA 0,0,0,0,0,0,0,0,0,0
     0,0,0,0,0,0,0,0
84   2320 DATA 0,0,0,0,0,0,0,0,2,
     160,0,6,162,128,5,170,633
42   2330 DATA 160,1,165,160,1,16
     5,160,1,161,64,1,160,0,1,160
     0,1364
C7   2340 DATA 1,160,0,2,168,0,6,
     168,0,5,80,0,0,0,0,7,597
A4   2350 DATA 0,0,0,0,0,0,0,0,0,0,
     0,0,0,0,0,0,0,0
8E   2360 DATA 0,0,0,42,0,0,170,1
     28,2,166,160,6,150,160,6,133
     ,1123
12   2370 DATA 160,5,161,64,6,170
     ,0,5,170,128,1,32,160,2,150
     160,1433
89   2380 DATA 6,165,160,5,170,16
     0,1,106,128,0,85,0,0,0,0,28
     1014
C4   2390 DATA 0,0,0,0,0,0,0,0,0,
     0,0,0,0,42,0,0,42
4C   2400 DATA 104,0,0,104,0,0,17
     0,0,1,170,0,1,104,0,0,104,75
     0
72   2410 DATA 0,0,104,0,0,104,0,
     0,104,0,0,104,0,0,104,0,520
86   2420 DATA 0,104,0,0,106,0,0,
     58,0,0,28,0,0,0,0,26,346
D4   2430 DATA 0,0,0,0,0,0,0,0,0,
    0,0,0 0,0 0,0 0
39  2440 DATA 0,0,0,0,0,0,0,0,0 10
    ,130 160 26 134 160 22 134 7
    75
30  2450 DATA 120 6 134 120,6 13
    4 120,6,134 120,6 134,120 6
    130 120,1472
12  2460 DATA 6 170,120 5 170 16
    0,1,166,160 1,85 84,0 0,0 0,
    1100
3C  2470 DATA 0 0 0 0 0 0 0 0 0 0
    0 0 0 0 0 0 0 0 0
08  2480 DATA 0 0 0 0 0 0 0 0 0 10
    ,0,160 26 1,160,22,1,300
20  2490 DATA 120 6 2 120 6 134
    120 6 134,120,5 134,0 1,170
    0 1110
D5  2500 DATA 1,170 0 1 104 0 0
    104 0 0,80,0,0 0 0 2 462
04  2510 DATA 0,0 0 0,0,0,0 0,0
    0,0 0 0 0 0 0 0 0
52  2520 DATA 0 0 0 0 0 0 0 0,42
     40 160 105,105 160,90 105 8
    24
FD  2530 DATA 160 26 105,160 26
    105 160 26 105 160,26 105 16
    0 26 170 180 1680
2C  2540 DATA 26 170,160 22 105
    120 4 01 0 0 3,0,0,0 0 0,598

6C  2550 DATA 0 0 0 0 0,0 0,0 0
    0 0 0,0,0 0 0 0 0
6F  2560 DATA 0 0 0 0 0 0 10,2 12
     26,6 126 26,6,128,26 130 62
    4
AC  2570 DATA 128 22 154 0 5 160
    ,0 1,160 0 2 170,0,5 154 0 5
    70
0A  2580 DATA 6 154 120 18 22,12
    6 26 6 120 21,5 64,0,0 0 223
    ,521
A5  2590 DATA 0 0 0 0 0 0 0,0 0
    0 0 0,10,162,160 26,366
DC  2600 DATA 166,100 22 133 160
     6 128 160 6 128 160 6 130 1
    60 6 162 1703
19  2610 DATA 160 6 170,160 5 17
    0 160 1 105,160,0 85 160 2 1
    28 160 1632
58  2620 DATA 6 130 160 5 170 12
    0 1,106 0 0 84 0 0 0,0,146,0
    36
B3  2630 DATA 0 0 0 0,0 0 0 0 0
    0 0 0 0 0 0 0 0 0
8F  2640 DATA 0 0 2 170 160 6 17
    0 160 6 166 160,6 145 160 6
    133,1454
E9  2650 DATA 160,5 2,120 0 10 1
    20 0 42,0,0 160 0 2 160 160
    865
5C  2660 DATA 6 130 160,5 170 16
    0 6 170 160 5 85 64 0 0,0,32
     1154
E8  2670 DATA 0,0 0 0 0 0 0 0 0 0
    0 0 0 0 0 0 0 0
00  2680 DATA 0,0 0,10 0 0,42 12
    0 0,42 120 0 170 150 1 170 0
    51
28  2690 DATA 150 1 170 160 1,17
    0,160 1,170 160 1 170 180 1,
    106 120 1715
37  2700 DATA 0 135,120 0,26,0,0
     21 0,0 0 0,0 0 0 191,382
33  2710 DATA 0,0,0 0,0 0,0,0,0,
    0 0 0 0 0 0 0 0 0
EF  2720 DATA 0 0 0 170,160 1 17
    0 160,1,170 150 1,170 150,1
    170 1454
65  2730 DATA 160 1,170 160 1 17
    0 150 1 170,160,1 170 160 1
    170,160 1815
8A  2740 DATA 1 170 160 1,170,16
    0 1 85 64 0 0,0,0 0,0,0,812
```

SAMPLER 64

Continued from last issue

PROGRAM DATA 3

```
35  5 CH=0 L=3985
08  10 POKE53280,0 POKE53281,0
5E  20 PRINT"[CLR]
15  30 PRINT"DATA LOADER 3"
1A  40 PRINT"[HOME DOWN2]POKE LO
    CATION  L
81  50 FOR I=1 TO 8
5A  60 READ A
9A  65 IF A<0 THEN 120
F0  70 POKEL A CH=CH+A L=L+1
D2  80 NEXT
4E  90 READ SUM
3D  100 IF SUM<>CHTHEN PRINT"CHE
    CKSUM ERROR IN LINE"PEEK(64)
    *256+PEEK(63) STOP
5A  110 CH=0 GOTO 40
F6  120 PRINT"READY TO SAVE PROG
    RAM"
E9  130 PRINT PRINT"PRESS RETURN
    "
AE  140 GETA$ IFA$<>CHR$(13)THEN
    140
35  150 PRINT"[CLR]POKE 43,1 POK
    E44,8 POKE45 0 POKE46 54 SAV
    E"+CHR$(34),
92  160 PRINT"SAMPLER64"+CHR$(34
    )+",8"
4E  170 POKE631,19 POKE632,13:PO
    KE198,2
CA  500 DATA 0 0 0,0,0 0 0 0,0
A3  501 DATA 0 0 0,0,0,6,1,1,8
84  502 DATA 6,0 0,0,0 0 0 0 6
08  503 DATA 0 0 0,0 0 0 0,0 0
0A  504 DATA 0 0 0,0,0 0,0,0,0
01  505 DATA 1 1,1,1,1,1,1 1 8
D5  506 DATA 1 1 1,1,0,6,1,1,12
1E  507 DATA 6 0 0 0,0,0 14 14,3
    4
AA  508 DATA 14,14,14,14,14,14 1
    4 14,112
80  509 DATA 14,14,14 14,0,0,1,2
    ,50
44  510 DATA 1 1 1,1 1 1,1 1 8
3E  511 DATA 1 1 1,1 0 6 1,1,12
61  512 DATA 6,0,0,0,0 0,0 0,6
70  513 DATA 0 0,0 0,0 0,0,0 0
85  514 DATA 0 0,0,0,0,2 1,1,2
8E  515 DATA 1 1 1 1,1 1,1,1,8
CC  516 DATA 1,1 1,1,0,6,1,1 12
53  517 DATA 6 0 0,0 0,0,14 14,3
    4
38  518 DATA 14,14,14,14 14,14,1
    4,14,112
6E  519 DATA 14,14,14,14,0,0,1,1
    ,58
71  520 DATA 1 1 1,1,1 1,1,1,8
C9  521 DATA 1 1 1,1,0,6,1,1,12
7F  522 DATA 6,0,0,0 0 0 0 0 6
8E  523 DATA 0 0 0 0 0 0 0 0,0
8F  524 DATA 0 0,0,0,0 0,1 1 2
84  525 DATA 1,1,1,1 1 1,1 1 8
AE  526 DATA 1 1 1 1,0 6 1,1,12
F9  527 DATA 6,0,0,0,0,0,14 14 3
    4
C3  528 DATA 14 14 14,14,14 14 1
    4,14 112
8A  529 DATA 14,14,0 0,0,0,0 0,2
    8
23  530 DATA 0 1,1 1,1 0 0 0 4
A8  531 DATA 0 0 0 0 0 6 1 1,8
65  532 DATA 6 0 0 0 0 0 0 0 6
24  533 DATA 0 0 0 0 0,0 0 0 0
E8  534 DATA 0 0 0 0 0 0,0 0
EA  535 DATA 0,0 0 0 0 0 0 0 0
8F  536 DATA 0 0 0 0 0 8 1 1 8
```

```
A3  537 DATA 6 6,0,0 0 0 0 0 12
AF  538 DATA 0,0,0 0 0 0 0 0 0
AE  539 DATA 0,0,0 0,0 0 0 0 0
A0  540 DATA 0 0 0 0 0 0 0 0 0
5A  541 DATA 0 0 0 0,0,6,1,1 8
2F  542 DATA 6 6 6 6 6 6 6 6 48
2E  543 DATA 6 6 6 6 6,6,6 6 48
2D  544 DATA 6 6 6 6,6,6,6 6 48
2C  545 DATA 6,6,6,6,6 6 6 6 48
14  546 DATA 6,6,6 6 6,6,1,1,38
9E  547 DATA 1,1,1,1,1 1 1 1 8
9D  548 DATA 1,1,1 1,1,1,1,1,8
9C  549 DATA 1,1,1,1,1,1 1,1 8
D3  550 DATA 1 1 1 1,1 1,1,1,8
DC  551 DATA 1 1 1,1 1 1 1,0 7
D3  552 DATA 0,0 0,0 0 0 0 0 0
D8  553 DATA 0 0 0 0 0 0,0 0 0
9F  554 DATA 0 0 0 0,0 0 0 0 0
9E  555 DATA 0,0,0 0 0 0 0 0,0
9D  556 DATA 0 0 0 0 0,0,1,0 1
9C  557 DATA 0 0,0,0 0 0 0,0,0
C3  558 DATA 0,0 0 0 0,0,0,0 0
C2  559 DATA 0,0 0 0,0,0,0 0 0
C1  560 DATA 0,0,0,0,0 0 0 0,0
C0  561 DATA 0 0,0 0,0,0,0,0,0
07  562 DATA 0 0 0 0 0,0,0 0 0
06  563 DATA 0,0 0 0 0 0 0,0 0
05  564 DATA 0,0,0 0 0,0 0,0 0
04  565 DATA 0 0,0 0 0 0 0 0 0
40  566 DATA 0,0,0 0 0 0 0,0,0
4A  567 DATA 0 0 0 0 0 0,0 0 0
49  568 DATA 0 0 0 0 0,0,0 0,0
34  569 DATA 0 0 0 0 0 0 0,0 169 1
    69
F8  570 DATA 5 133,1,120 169 11,
    141,17,587
7C  571 DATA 208,169 176,162,0 1
    41 6,220 1082
95  572 DATA 142 7,220,173 13,22
    0 169 25 965
F3  573 DATA 141,15,220 173 13 2
    20 41 16 839
3F  574 DATA 201,0 240 11 169,15
    141,24,801
A9  575 DATA 212,32,55,240 76 20
     240,169,1056
39  576 DATA 0 141 24,212,32 55
    240 76 784
E5  577 DATA 20,240 160 0,145,25
    1 230 251 1305
79  578 DATA 208 0 230,252 165 2
    52 201,208 1524
C1  579 DATA 240,1,96,76,112,243
     0 169 937
25  580 DATA 0 133,251,169 12 13
    3 252 76,1026
64  581 DATA 0,240,0 0 0 0 0 120
    ,360
D6  582 DATA 165,11,141 17 208 1
    69 53,133 981
24  583 DATA 1 160 0,165 0,133 2
    51,165,883
F7  584 DATA 12,133 252 177,251,
    141 24,212 1202
84  585 DATA 162 0,232,224,5,208
    ,251 208,1202
26  586 DATA 208 241 230,252,165
     252 201,208,1757
36  587 DATA 208 233 76 165 241,
    0 0,169 1092
75  588 DATA 1,133,65 76,00 240
    165 65 825
05  589 DATA 201,1,208,3 76 96 2
    40 201 1026
1C  590 DATA 2,240 3,76 165,241,
    76 32,835
E8  591 DATA 241,0,0,0,0 0,0 169
    ,410
68  592 DATA 0 133,251 169,12 13
    3,252,165,1119
B4  593 DATA 2 133 65,169 5 133
    1,120,628
81  594 DATA 169,11,141 17,208,1
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     69,176,162,1053
C7   595 DATA 0 141,0,220 142,7,2
     20,173,909
1F   596 DATA 13 220,169,25,141 1
     5,220 160 963
98   597 DATA 0,162 8,160 0 133,2
     24,498
30   598 DATA 173 13 220 41,16,24
     0,30,169,902
A6   599 DATA 15 141 24 212 56 38
     ,2,202 690
A2   600 DATA 208,237,165 2,145 2
     51 230,251 1469
3E   601 DATA 208,0 230,252 165 2
     52,201,209,1524
3A   602 DATA 240 11 76,216 240 1
     69,0 141,1093
D1   603 DATA 24,212,76,230 240,7
     6,112 243 1221
ED   604 DATA 0,0,0,0 0 0 0 0 0
30   605 DATA 2,0 0 0 0 0 0 120 1
     20
7E   606 DATA 169 11 141,17 208,1
     65 53 133,901
E0   607 DATA 1 169 0 133,251 169
     12 133 958
2E   608 DATA 252 160,0 177 251 1
     33 2,160 1135
D8   609 DATA 8,165 2,10,133 2 17
     6,29 525
0A   610 DATA 169 0,141,24 212 23
     4 234 234 1240
10   611 DATA 234,136 208 237,230
     ,251 208 8 1512
CE   612 DATA 230 252 165 252 201
     208,240 15 1563
73   613 DATA 76 50 241 234 234 2
     34,234 169 1472
3C   614 DATA 15 141 24,212 76,70
     ,241 76 866
0D   615 DATA 165,241,0,0,0,0 0 1
     20 525
20   616 DATA 169,11 141 17 208 1
     65 53 133,901
D8   617 DATA 1 160,255 169 0,133
     ,251 169,1138
4A   618 DATA 207 133 252 177,251
     ,141,24,212 1397
37   619 DATA 162,0,232 224 5 208
     ,251 136,1218
C0   620 DATA 192,255 208 239 198
     ,252,165 252,1761
9A   621 DATA 201 12 208,231 76,2
     11 10,0,949
F5   622 DATA 0 0 0 0,165,66 201,
     1 433
60   623 DATA 240 3 76,224 9,76 2
     11 10,849
E9   624 DATA 0,0,0,0 120 169 11,
     141 441
0C   625 DATA 17 208,169 53 133 1
     ,169 255,1005
5D   626 DATA 133,251 169,207 133
     252,160 0,1305
9A   627 DATA 177,251 133 2 160 0
     ,165 2 898
0E   628 DATA 74 133 2 176 31 169
     ,0,141 726
2D   629 DATA 24 212 234 234,234
     136 208 230 1520
74   630 DATA 198 251,234 165,251
     ,201 255 208 1763
A2   631 DATA 0 198 252,165,252 2
     01 12,240 1320
20   632 DATA 14,76,199,241,234 2
     34 234 165,1401
1F   633 DATA 15 141 24,212 76 21
     9 241,76 1004
A0   634 DATA 211 10 234 98 160,0
     169,0 880
00   635 DATA 153,0,4,153 0 5 153
     ,0,460
50   636 DATA 6 153 0 7,153 0 216
     ,153 608
5E   637 DATA 0 217,153 0 218 153
     0 219 968
C2   638 DATA 200 208 225 160 0 1
     85 60 242 1284
2F   639 DATA 201,255 240 12,153
     0 4 165 1034
55   640 DATA 1 153 0 216 200,76,
     38 242 926
70   641 DATA 76 115 242 32 32,16
     ,18 5 540
0D   642 DATA 13 19 32 19,16 1,3,
     5 114
F1   643 DATA 32 20 15,32,19 20 1
     ,18 157
EC   644 DATA 20 32 19,1,13,10 12
     5,118
49   645 DATA 32,16,12 1 25,9,14
     7,116
3D   646 DATA 32,255 0,165 85 201
     0 208 526
FD   647 DATA 3,76 211,10 201,1,2
     08 3 713
67   648 DATA 76,5 242,76,160,243
     ,32 240,1274
75   649 DATA 242,234 234 234 234
     ,120 169 11,1470
16   650 DATA 141,17 208 160,0,13
     2 251 169,1076
E0   651 DATA 12,133,252,177,251,
     141,24,212 1202
3E   652 DATA 173,1 220 201 251 2
     40 21,162 1263
0B   653 DATA 0 232,224 5,208,251
     ,208 208 1326
53   654 DATA 234 238,252,165,252
     ,201 208 208 1750
97   655 DATA 226,76 211,10,165 2
     51 141 119 1155
DA   656 DATA 2 165,252 141 120 2
     ,173 1,856
59   657 DATA 220,201 255 208 249
     177 251 141,1702
50   658 DATA 24 212 173 1 220,20
     1 239 240 1310
EA   659 DATA 10 162 0 232 224 5
     208,251,1100
3A   660 DATA 200 208 234,238 252
     ,165 252 201 1742
5A   661 DATA 205 200,226 165 251
     ,141 121 2 1322
03   662 DATA 169 252,141 122 2,7
     6,0 243,1001
D4   663 DATA 0 0,0 0,0,0 0 173 1
     73
D2   664 DATA 1 220,201,239 208,2
     49,173 1 1282
4F   665 DATA 220 201,255,208 248
     96 0 173,1402
5F   666 DATA 120 2 141,113 240 1
     41 154 241 1152
F7   667 DATA 174 122 2 142 136,2
     40 202 142 1160
2B   668 DATA 125 241,76,211 10 0
     0 0 667
AE   669 DATA 169,12 141 113,240,
     141 47 241,1104
47   670 DATA 141 154 241,141 235
     241 162,208 1527
B4   671 DATA 142 136 240 142 86
     241,202,142 1331
63   672 DATA 129 241,142,198 241
     169,255 141 1514
E5   673 DATA 192,241 169 0 141,4
     3 241 76 1103
5F   674 DATA 211,10,0,169 12 141
     113 240 896
06   675 DATA 141,47 241 141 154
     241 141 235 1345
C8   676 DATA 241,162 208 142 136
     240 142 86,1357
8A   677 DATA 241,202,142 129 241
     ,142,198,241,1534
7A   678 DATA 169,255 141 192,241
     169,0,141 1380
23   679 DATA 43,241 76 55,11 0 0
     ,169 635
B7   680 DATA 12 141,113 240 141
     47 241 141 1076
FC   681 DATA 154 241 141,235 241
     ,162 208 142 1528
0D   682 DATA 136 240 142,86,241,
     202 142 129,1318
38   683 DATA 241,142 198 241 169
     ,255,141 192 1577
D5   684 DATA 241 169 0 141 43,24
     1 76,224 1135
09   685 DATA 5 0 0,0 0 0 0 160 1
     69
C7   686 DATA 0 169 0 153,0 4 153
     ,0 479
37   687 DATA 5 153 0,6 153 0 7 1
     53,477
8A   688 DATA 0 216,153 0 217,153
     0,218,957
A6   689 DATA 153 0,219 200 208 2
     29 160,0 1169
5E   690 DATA 185,60 242 201 255
     240,12 153 1348
F1   691 DATA 0 4 169 1,153 0 216
     ,200 743
5F   692 DATA 76 193 243 173 1 22
     0 201,239 1346
56   693 DATA 208 249,173 1 220,2
     01 255 208 1515
1A   694 DATA 245 120 169 11 141,
     17 208 169 1084
72   695 DATA 0 133 251 169 12 13
     3 252,160 1110
E8   696 DATA 0 177 251 133,2,173
     ,1,220 957
3D   697 DATA 201 251 240,45 160
     6 165 2 1072
7F   698 DATA 10 133 2,176 25 169
     0,141 896
0E   699 DATA 24 212 234 234 136
     208 235 230 1517
A8   700 DATA 251 208 8 230 252 1
     65 252 201 1567
F1   701 DATA 208 240 11 76 240 2
     43 169 15 1208
01   702 DATA 141 24 212 76 11 24
     4 76 211 995
92   703 DATA 10 165 251 141 119
     2,165 252 1105
F6   704 DATA 141 120 2 173 1,220
     ,201 255 1113
A8   705 DATA 208 243 160 0 177 2
     51 133 2 1180
3F   706 DATA 173 1 220 201 239 2
     40 40 160 1274
8C   707 DATA 8 165 2 10 133 2 17
     6,29 519
12   708 DATA 169,0 141 24,212,76
     ,120,244 994
61   709 DATA 230 251 208,8 230 2
     52 165 252 1596
74   710 DATA 201 208,240,11,76,5
     9 244 169 1208
06   711 DATA 15 141 24 212,76 86
     ,244 165 969
51   712 DATA 251 141 121,2 165 2
     52,141,122 1155
1D   713 DATA 2 76 136 244 76,122
     ,244 234 1134
EA   714 DATA 136 208 198,76 89 2
     44,0 173 1224
0E   715 DATA 119 2 141 43,241 17
     3,120 2 841
33   716 DATA 141 47,241 174,122,
     2 173 121 1021
F1   717 DATA 2 201,120 176,5 142
     ,86 241 982
17   718 DATA 76 168 244 202 142,
     86,241,173 1332
72   719 DATA 121 2 141,192,241 1
     73 122 2 994
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37   720 DATA 141,196 241,173 120
     ,2,141,239,1253
31   721 DATA 241,76,211,10 0,0,0
     ,165,703
1E   722 DATA 55,201,1 240,3 76 2
     11,10,687
78   723 DATA 173 113 240,141,255
     ,255,173 136,1486
28   724 DATA 240,141,255,255,0,0
     ,0,0,891
5E   725 DATA 0 0,0,0,0,0,0,128,1
     28
A2   726 DATA 169,11,141,17 208,1
     60 0,169,875
76   727 DATA 0,133 251,173,113,2
     40 133 252,1295
25   728 DATA 177,251,141,24,212,
     162,0 232,1199
87   729 DATA 224,5,200,251,234 2
     34,208 208 1684
D9   730 DATA 239 230 252,165 252
     ,205 136 240 1719
A9   731 DATA 200,230 76,11,245 0
     ,0 120 690
CC   732 DATA 169,11 141,17,208,1
     60 0,169,875
18   733 DATA 0,133,251,173,113,2
     40 133 252 1295
47   734 DATA 177 251 141,24,212
     162,0,232 1199
D4   735 DATA 224,1,200,251 208 2
     08 241,230 1563
E5   736 DATA 252 165 202 205 136
     ,240,200 232,1690
05   737 DATA 96,0 0 0 0,0 0,160,
     256
19   738 DATA 0 169,1 153,0 216 1
     85,88,812
45   739 DATA 245,201 255,240,7 1
     53 0,4,1105
E8   740 DATA 200,76,66,245 76 11
     6,11 32,822
E5   741 DATA 32,32 32,32 32,32,3
     2,32,256
DA   742 DATA 32,32,21,19,5,32,28
     ,0 169
59   743 DATA 5,19,5,32 11,5 25,1
     9,121
28   744 DATA 46,46,46,32,32,32,3
     2,32 298
41   745 DATA 32,32 32,32,32 32,3
     2,32 256
44   746 DATA 32,32,32 32,32,32 3
     2,32 256
25   747 DATA 78 32,32,32,32,32,3
     2 32 302
C2   748 DATA 32,32,32 32,32,32,3
     2 32,256
8D   749 DATA 32,32,32,32,77,32 3
     2,32 301
68   750 DATA 32,32,32,32 32,32,3
     2 32,256
5B   751 DATA 32,32,32,32 32,32,3
     2 32 256
25   752 DATA 32,17,32 23 32 5,32
     ,18 191
C0   753 DATA 32,20,32 25 32 21,3
     2,9,223
25   754 DATA 32,15,32,18,32,32,3
     2 32 225
87   755 DATA 32,32,32,32,32,32 3
     2,32,256
2A   756 DATA 32 32,32,32 32,32 3
     2,32,256
F5   757 DATA 32,32,32,32,32 32,3
     2 32 256
20   758 DATA 32,32,32,32,32,32,3
     2,32,256
23   759 DATA 32,32 32 32,32,32 3
     2,32 256
56   760 DATA 32,32 32,32 32 32 3
     2,32,256
D1   761 DATA 32 32,32,32,32,32,3
     2,32,256
3C   762 DATA 32 1,32 15,32,4,32
     8 156
95   763 DATA 32 7,32,0 32,18 32,
     11 164
11   764 DATA 32 12,32 58,32 32 3
     2,32 262
30   765 DATA 32,32,32,32,32 32 3
     2 32 256
F0   766 DATA 32,32,32,32,32 32 3
     2 32 256
F8   767 DATA 77,32 32,32 32,32 3
     2,32,301
39   768 DATA 32,32,32,32,32,32,3
     2,32,256
34   769 DATA 32,32,32,32,78,32,3
     2,32,302
D7   770 DATA 32 32,32 32,32,32,3
     2 32,256
3A   771 DATA 32,32 32,32 32,32,3
     2,32,256
C7   772 DATA 32,32,32 32,32,32,2
     55,0,447
5A   773 DATA 0,0,0,0,0,80,0 141,
     221
C0   774 DATA 54,246,160 0 105 14
     8,246,205 1285
21   775 DATA 54 246,240,0 200 19
     2,21,209,1209
F5   776 DATA 243,76,116,11,192,1
     0,176,12,836
3F   777 DATA 165 181,246,141,42,
     245,32,16,1068
DA   778 DATA 245,76,116,11 165 1
     81,245,141,1201
40   779 DATA 253,246,32,16 247,7
     6 116 11,997
FC   780 DATA 0,0 0,0,81,87,65,82
     315
CE   781 DATA 84,89 85 73,79,80 6
     5 83 638
1E   782 DATA 65,70 71,72,74,75 7
     6,58 554
61   783 DATA 0 0 0,0,0,0,0,0,0
A8   784 DATA 0,0,0 0,12,5,8 7,34

8E   785 DATA 6,5,4,3,2,1 10,5,40

D3   786 DATA 8,7,6,5 4,3,2 1 36
25   787 DATA 0 8,0 0 0,0 0 0 8
24   788 DATA 0,0,0 0,0 0 0,8 8
CF   789 DATA 0,0 0,0,0 0 0,120 1
     20
E5   790 DATA 165 11,141,17,200 1
     69,53 133,901
11   791 DATA 1,160,255,153 0 133
     ,251,165 1138
75   792 DATA 207,133,252,177,251
     ,141,24 212 1397
20   793 DATA 162,0,232 224 10
     0,251,136 1223
D3   794 DATA 192 255,208,239 109
     ,252,165 252 1761
DC   795 DATA 201,128 208 231,96
     0,0 173 1037
C1   796 DATA 125,241,141,237,246
     ,173,128,241 1533
82   797 DATA 141,241 246,173 154
     ,241,141,10,1347
8F   798 DATA 247,76,224 246 0 0
     0 0,793
5D   799 DATA 0,0,0,0,0,0 0 180 1
     80
C8   800 DATA 0,185,72,247 205,16
     5,240 12 1212
06   801 DATA 153,0,4,165,1 153,0
     ,216 596
A5   802 DATA 200 76 58,247,76,11
     4 11,32 856
6E   803 DATA 1,10,5,32,25,15,21,
     32,143
EC   804 DATA 19,21,16 5,32,25 15
     ,21,158
75   805 DATA 32,2,5,18,1,5,32,20,
     15,158
51   806 DATA 32,5,18,1,18,5,32,1
     5,131
86   807 DATA 1,13,16,12,5 32,32
     32,143
81   808 DATA 32,32,32,32,32,32,3
     2,32,256
04   809 DATA 32,32,32,32,32,32,3
     2,32,256
5F   810 DATA 32,32,32,32,32,32,3
     2,32,256
E2   811 DATA 32,32,32,32,32,32,3
     2 32,256
6D   812 DATA 32,32,32,32,32,32,3
     2,32,256
AD   813 DATA 32,32,32,32,32,32,3
     2,32,256
5D   814 DATA 32,32,32,32 32,32,3
     2,25 249
D3   815 DATA 47,14,255,0 0 0,0,1
     60 476
7A   816 DATA 0,169,0 133,251,169
     10,133 865
8B   817 DATA 252,165,0,165,251,2
     00 252,251 1476
23   818 DATA 230 252,165 252,201
     00 229,241 1757
F5   819 DATA 169,0 133,65 76,211
     0,0 661
A5   820 DATA 0,0,0,0,0,168,0 168 0
     ,168
E8   821 DATA 153,0,4,153 0 5 158
     ,0 468
B3   822 DATA 5,153,0,7,153 0 216
     153,598
7C   823 DATA 0,217,153 0,218,153
     ,0 219 960
7C   824 DATA 200 220 227,76 40 2
     47 0,1086
8C   825 DATA 0,0 0 0 0 0,0 169 1
     69
27   826 DATA 0,133 251 169 0,169 1
     ,1,153 867
BE   827 DATA 0 216,153 0,217,153
     0 218,857
E8   828 DATA 153 0 219 153,208,2
     41,165 251 1437
43   829 DATA 251,200,2 200,3,76 9 2
     48,201,588
59   830 DATA 1 200 3 76,91 248,2
     01,2,828
5A   831 DATA 200,3,76 133,248 16
     ,175,249,1157
5D   832 DATA 168,62,130 1 169 0,
     169,0,700
DA   833 DATA 200 153 0,4,165 0,2
     20 153,817
5F   834 DATA 0 5,165 0 218,153,0
     0 553
87   835 DATA 165,0 211,153,0,7 0
     00,208,564
A6   836 DATA 225,169,53,133,1,203
     0,251,75,1137
E7   837 DATA 200,11,165 52,133,1
     ,160,0 780
7C   838 DATA 165,0 212 153,0 4,1
     65,0,753
7E   839 DATA 213,153,0,5,165 0,0
     14,153,823
1C   840 DATA 0,6,165,0 216,153,0
     ,7,550
7F   841 DATA 200 200,229,165,53,
     133 1,230,1222
7E   842 DATA 251,76 200 11,165,5
     2,133 1,895
10   843 DATA 156,0 165,0,216,153
     0,4,718
86   844 DATA 165,0,217,153 0 5,1
```

```
      85 0,745
FA  845 DATA 218,153,0 6,185,0 2
      19 153,534
02  846 DATA 0 7,200,200,229,169
      ,53,133 999
D5  847 DATA 1,230,251,76,202,11
      169,52,992
55  848 DATA 133,1,162 0 185,0,2
      20 153 852
C5  849 DATA 0,4,185 0 221,153,0
      ,5,588
7C  850 DATA 185,0 222 153,0,6 1
      85,0,751
C0  851 DATA 223,153,0,7,200,200
      ,229,169,1189
78  852 DATA 53,133,1,230 251 76
      ,233,11,988
20  853 DATA 0 0,0,0,0 0 0 0 0
2A  854 DATA 0,0 0 0,0 0 0 0,0
29  855 DATA 0,0,0,0,0 0 0 0 0
20  856 DATA 0 0 0 0,0 0 0 0 0
EF  857 DATA 0,0,0,0 0 0,0 0 0
EE  858 DATA 0,0,0 0 0 0 0,0 0
ED  859 DATA 0 0 0 0 0,0,0,0,0
EC  860 DATA 0 0 0 0 0 0 0,0 0 0
09  861 DATA 0 0 0,0 0 0 0 20 20

61  862 DATA 0 10,0,158 50 57 48
      51,382
5D  863 DATA 32,169,72 69 76,32,
      84 72,686
C5  864 DATA 79,77,32,40,67 41 3
      3 56 431
32  865 DATA 56,0,0,0,0,0,169,14
      7,372
5A  866 DATA 32,176 0,169,11,141
      ,17,229,762
44  867 DATA 160,0 165,0,224,153
      ,0,4,726
0E  868 DATA 165,0,225,153 0,5 1
      65,0,753
52  869 DATA 226 153 0,6,165,0,2
      27,153,950
11  870 DATA 0,7,165,0,228,153 0
      ,216 789
D1  871 DATA 185,0,229,153 0,217
      ,165,0,389
C5  872 DATA 230,153,0,218,165,0
      ,231,153 1170
16  873 DATA 0 219,200,200,205,1
      69 0,32,1233
F5  874 DATA 60 9 234,234,234,16
      5 27,141,1180
76  875 DATA 17,208,32 228 255,2
      01 0 240 1181
2C  876 DATA 249 201,49,144,245,
      201 55,176,1320
1E  877 DATA 241 56 233,48,133,2
      51 201,6,1169
3F  878 DATA 209 3,76 102 254,16
      4,251,185 1243
57  879 DATA 169,0,133,252,185 1
      67 0 133,1045
22  880 DATA 253 168 252 0,141,3
      2 208,169 1163
28  881 DATA 55 133 1 88 96 0 15
      2 249,814
93  882 DATA 216 241,90,0 0 0 0
      9 554
03  883 DATA 9,9,9,0,0,0 32 218,
      269
CA  884 DATA 255 128,169,53 133
      1 58 169 596
33  885 DATA 55 133,1,88 96,0,16
      9,147 689
36  886 DATA 32,210,255,169 207
      160 0,32 1073
F6  887 DATA 30 171,76 240,0,73
      78 83,759
00  888 DATA 69,82 84 32,84 65,0
      0 69 565
01  889 DATA 32,38 32 80 82 69 8
      3 83,439
56  890 DATA 32 82 65 84 85 82 7
      8 0,512
64  891 DATA 0,0,0,0,0,0,32,228,
      260
40  892 DATA 255 201,13 240,7 16
      9 55 133 1073
80  893 DATA 1,76,240,0 169 7,13
      3 1,635
C1  894 DATA 120 169,11,141,17,2
      08 173,13 852
E8  895 DATA 228,169,26 141 15,2
      20 173 13,976
F9  896 DATA 220 41,16,240,8 169
      ,15 141 852
1A  897 DATA 24,212,76,36,9,169,
      8,141 867
3C  898 DATA 24,212,173,1 220 20
      1 255,240,1326
44  899 DATA 229 169 63,133,0,16
      9 55,133 951
FD  900 DATA 1,169,27,141,17,208
      ,88,76 727
64  901 DATA 32,8 141,32,208,141
      ,33,208,803
1E  902 DATA 169,55,133,1,88 96,
      0 0 542
61  903 DATA 0,0,0,0,0,0,169,147
      ,316
82  904 DATA 32,210,255,169,11,1
      41 17,208,1043
D8  905 DATA 128,169 53,133,1,16
      0,0,185,821
7F  906 DATA 0 232,153 0,4,185,0
      ,233 807
DD  907 DATA 153,0,5 185,0 234,1
      53 0 730
67  908 DATA 6,185 0 235,153,0,7
      185,771
A0  909 DATA 0 236,153,0,216 185
      ,0 237 1027
1C  910 DATA 153,0,217,185,0,238
      153 0,948
4D  911 DATA 218,185 0 239,153 0
      219 200,1214
A2  912 DATA 200 205 169,55,133
      1 88,169 1020
F5  913 DATA 27,141,17,208 32 22
      0,255 201 1109
05  914 DATA 0,240 249,201 59,14
      4 245,201,1329
34  915 DATA 56,176 241,56 233 4
      0 133 251 1194
89  916 DATA 201,7,208,3,76,32,8
      ,164 699
DE  917 DATA 251,185,199,9,133,2
      52 185,207 1421
37  918 DATA 9,133,253 180,252 0
      ,110,0 881
3D  919 DATA 144,240,154,156 0 0
      ,10,10 762
60  920 DATA 11 10 11,11,0,0 120
      169,332
64  921 DATA 53,133,1 76 144,240
      ,169 63 875
7F  922 DATA 133 0,169 55 133 1,
      169 11 671
C1  923 DATA 141,17 208,60 76,32
      ,8 120,659
07  924 DATA 169 53,133 1 76 151
      ,240,120,949
8D  925 DATA 169 53,133,1 76 176
      240 169,1017
5D  926 DATA 0,133,65,76 32,0,16
      9 147,639
89  927 DATA 32,210,255,169,23,1
      60,10 32 891
54  928 DATA 30 171,76 43,10 67,
      85 82,564
D3  929 DATA 82,65,78,84 32,83,0
      0 69 577
ED  930 DATA 69,68,32,73,83,32,0
      ,0,357
15  931 DATA 0 120 169,53 133 1,
      174 125,775
BA  932 DATA 240,169,55 133 1,88
      ,169,0,855
F7  933 DATA 32,205,169 32,220,2
      55,201,0 1142
14  934 DATA 240,249,201,3,208 3
      ,76,80,1060
82  935 DATA 9,201 43 240,7,201,
      45,240 986
0E  936 DATA 19,76,61,10 120 169
      ,53,133,641
6A  937 DATA 1,230 125 240 169,5
      5,133 1,952
24  938 DATA 80,76,0,10,120,169,
      53 133,857
8C  939 DATA 1,205,125 240,169,5
      5 133 1,932
C7  940 DATA 88,76,0 10,169,147,
      32 210,748
0E  941 DATA 255 169,133,160,10
      32 30,171 960
63  942 DATA 76,164,10,80 76 65,
      89,32 592
81  943 DATA 83,65 77,80 76 69,3
      2,82,584
7D  944 DATA 69,86,69 82,83 69 3
      2 79,569
D6  945 DATA 82,32,70 79 82,87 6
      5 82,579
23  946 DATA 68,0,32,228 255,201
      ,0,240 1024
56  947 DATA 249 201,82,240 7,20
      1,70 208 1258
5A  948 DATA 241,76,232,10,165 6
      5 201,0 930
5F  949 DATA 208,3,76 60 9 201 2
      ,240 815
77  950 DATA 0 120,169 53 133 1
      76 239 799
36  951 DATA 10,120 169 53 133 1
      ,76 181,743
A4  952 DATA 241,169,63,133,0,16
      9,55 133,963
DC  953 DATA 1 169 11 141 17 208
      ,88 169 804
0E  954 DATA 0 133 66,76,08 9 16
      9 1 534
08  955 DATA 133 88 76,241,9 173
      ,125,240,1063
32  956 DATA 141 141 241 76 112
      241 169,147 1266
F8  957 DATA 32 210 255 169 7,16
      0 11,32 876
01  958 DATA 30 171 76,49 11 83,
      69 76 565
82  959 DATA 65 67 84,13 13,49,3
      2 45,372
D9  960 DATA 32 82 69 83 84 79,8
      2 69,580
CA  961 DATA 32 84,79 32 58 65,7
      0 65 455
F5  962 DATA 85,76 84,13,13,58 3
      2 45 358
A4  963 DATA 32 67,82,79 58 0,0,
      32,372
52  964 DATA 220 255 201,0 240 2
      49,201 3,1377
56  965 DATA 208,3,76 60 9 201 4
      9 240,866
8F  966 DATA 12 201 50 208 234,1
      20 169,53,1047
3F  967 DATA 133,1 76 180 242,12
      0,169 53 894
1A  968 DATA 133,1 76 25 243,120
      169,53 828
45  969 DATA 133 1 76,60 243 169
      ,55 133,878
85  970 DATA 1 88 76 1,10 169 14
      7 32 524
F1  971 DATA 210 255 120 169,53
      133 1,76 1017
A4  972 DATA 64 245 169 55 133,1
      88 32 787
78  973 DATA 229 255 201,0,240 2
      49,201,3 1377
5A  974 DATA 208,3,76,211 10,120
```

```
    ,162,53,843
FD  975 DATA 134,1,76 56,246 0 1
    65,65,753
48  976 DATA 201,1,200,3,76 103
    11,76,679
70  977 DATA 211,10 120,169,53 1
    33,1,76,773
0E  978 DATA 213 247,169 55 133,
    1 00,32,938
AA  979 DATA 220 255,201,76,208,
    3 76,211,1260
10  980 DATA 10 201,89,240 3 76,
    169,11,799
E9  981 DATA 120 169 53 133,1 76
     176 247 975
CC  982 DATA 120,169,53 133,1,76
    ,0 240 800
EA  983 DATA 168,55 133 1 00 32
    220,255,961
78  984 DATA 201 0,240 249,201 3
    ,208 3,1165
05  985 DATA 76,211 10 201 32 20
    8 238 120 1096
EF  986 DATA 169 53 133 1 76 23
    240,169,872
48  987 DATA 66,133 1 88,32 220
    255 201,933
0B  988 DATA 32,208 249 76 211,1
    0 0,0 786
15  989 DATA 0 0,0,0 0 0,0,159 1
    93
E0  990 DATA -1
```

SET THE ALARM

PPLGRAM ALARM

```
3B  1
06  2 REM       ALARM   BASIC LO
    ADER
9E  3 REM        N P  GREGORY  0
    986
3E  4
F0  5 REM SYS 49152   TURN OFF
24  6 REM SYS 49152  A/PHHMM   A
    /PHHMM  STRING  1 - DISPLAY
     CLOCK
3D  7
86  10 RESTORE
BF  12 ADRS  - 49152
69  14 LINE  - 100
99  16 ELINE - 370
DB  18 C-0 T-0
2E  20
42  22 FOR LN - LINE TO ELINE ST
    EP 5
07  24 FOR A-0 TO 9
35  26 READ DT IF DT--1 THEN A-9
     GOTO 30
F0  28 POKE ADRS+C DT T-T+DT C-C
    +1 NEXT A
CE  30 READ CH IF CH<>T THEN PRI
    NT ERROR IN LINE  LN END
0C  32 T-0 NEXT LN
B4  100 DATA 169 0 141 7 194 173
     13 220 9 4 930
A6  105 DATA 41 127 141 13 220 3
    2 121 0 208 13 916
C0  110 DATA 120 169 49 141 20 3
     169 234 141 21 1087
41  115 DATA 3 88 96 32 254 192
    165 180 141 3 1154
F1  120 DATA 194 165 181 141 4 1
    94 32 254,192 165 15
78  125 DATA 180 141 5 194 165 1
    81 141 6 194 32 1239
D9  130 DATA 253 174 32 158 173
    32 163 182 201 27 1395
15  135 DATA 144 3 76 67 192 [illegible]
    173 136 2,141 1007
25  140 DATA 98 192 141 128 192
    141 141 192 56 32 1313
81  145 DATA 240 255 134 180 132
     181 173 0 4 133 1432
E1  150 DATA 182 104 168 169 0 1
    53 12 194 169 160 1311
F6  155 DATA 153 11 194 136 132
    183 32 102 228 164 1336
8E  160 DATA 183 177 34 32 71 17
    1 173 0 4 9 854
30  165 DATA 128 153 11 194 136
    16 233 165 182 141 1359
70  170 DATA 0 4 24 166 180 164
    181 32 240 255 1246
96  175 DATA 32 121 0 240 14 32
    253 174 32 158 1056
43  180 DATA 163 224 2 144 3 76
    67 193 138 74 1104
80  185 DATA 106 141 7 194 173 1
    4 220 9 128 141 1133
E5  190 DATA 14 220 173 15 220 9
    128 141 15 220 1155
4A  195 DATA 174 5 194 142 11 22
    0 174 6 194 142 1262
F5  200 DATA 10 220 160 0 140 9
    220 140 8 220 1127
74  205 DATA 41 127 141 15 220 1
    73 3 194 141 11 1066
3D  210 DATA 220 173 4 194 141 1
    0 220 140 9 220 1331
6F  215 DATA 140 8 220 120 169 8
    7 141 20 3 169 1077
87  220 DATA 193 141 21 3 173 13
     220 9 132 141 1046
7B  225 DATA 13 220 88 96 32 253
     174 32 158 173 1239
12  230 DATA 32 163 182 201 5 24
    0 3 76 8 175 1085
2A  235 DATA 160 0 177 34 201 65
     240 4 201 80 1162
A7  240 DATA 208 241 132 180 201
     80 208 4 169 128 1551
20  245 DATA 133 180 169 19 133
    182 32 43 193 200 1284
28  250 DATA 177 34 41 15 10 10
    10 10 133 181 621
74  255 DATA 200 177 34 41 15 5
    181 133 181 197 1164
1A  260 DATA 182 144 5 182 14 76
     35 164 166 182 1150
32  265 DATA 224 10 205 4 5 180
    133 180 169 96 1216
23  270 DATA 133 182 96 173 7 18
    4 16 58 72 173 1102
C0  275 DATA 136 2 141 123 193 1
    41 223 193 141 250 1543
6F  280 DATA 193 160 28 162 1 17
    3 11 220 16 2 966
D1  285 DATA 162 16 133 2 138 9
    128 153 0 4 745
24  290 DATA 165 2 41 127 170 32
     218 193 174 10 1132
8D  295 DATA 220 32 218 193 174
    9 220 32 218 193 1509
3B  300 DATA 173 8 220 104 41 12
    7 208 9 173 13 1076
D0  305 DATA 220 16 58 41 4 240
    54 160 0 174 967
D2  310 DATA 136 2,142 179 193 1
    85 10 194 240 15 1296
1D  315 DATA 77 8 194 153 0 4 17
    3 134 2 153 898
08  320 DATA 0 216 200 208 236 1
    73 7 194 9 1 1244
02  325 DATA 141 7 194 206 8 194
     208 13 169 20 1160
16  330 DATA 141 8 194 173 9 194
     73 1 8 141 9 1070
0A  335 DATA 194 76 49 234 169 1
    74 [illegible] 153 0 4 1253
6F  340 DATA 173 134 2 153 0 216
     138 41 240 74 1171
84  345 DATA 74 74 74 32 240 193
     41 15 24 105 872
2A  350 DATA 48 9 128 200 153 0
    4 173 134 2 851
3D  355 DATA 193 0 216 138 96 0
    0 0 0 0 643
8D  360 DATA 20 128 160 0 0 0 0
    0 0 0 308
55  365 DATA 0 0 0 0 0 0 0 0 0 0
    0
4E  370 DATA 0 0 0 0 0 0 0 0 0 0
    1 0
```

JACK IN THE BOX

[illegible]

```
[illegible] 1 PRINT "CREATING PROGRAM  [
    RVSON]BC  TILS[RVSOFF DOWN2
    ]
A8  10 BL-47 LN-50 SA-52480
5B  20 FOR L-0 TO BL CX-0:FOR D-
    0 TO 15 READ A CX-CX+A POKE
    SA+L*16+D A NEXT D
03  30 READ A PRINT  ".: IF A<>CX
     THENPRINT ERROR IN LINE  LN
    +(L*10) STOP
6A  40 NEXT L
B9  50 DATA 32 155 183 142 32 20
    8 32 155 183 142 33 208 32 1
    55 183 142 2017
83  60 DATA 134 2 32 155 183 142
     104 207 32 155 183 142 105
    207 32 155 1970
C9  70 DATA 183 142 106 207 96 3
    2 155 183 142 95 207 32 155
    183 142 96 2156
5E  80 DATA 207 32 155 183 142 9
    7 207 32 155 183 142 98 207
    32 155 183 2210
C5  90 DATA 142 99 207 32 155 18
    3 142 100 207 32 155 183 142
     101 207 168 2256
90  100 DATA 146 32 210 255 32 1
    58 183 224 1 208 5 169 16 32
     210 255 2135
0E  110 DATA 234 174 134 2 142 1
    02 207 174 101 207 142 134 2
     169 32 174 2130
95  120 DATA 97 207 172 95 207 3
    2 51 206 200 204 96 207 208
    247 232 236 2697
10  130 DATA 96 207 208 238 168
    176 172 95 207 174 97 207 32
     51 206 169 2506
08  140 DATA 189 172 96 207 174
    98 207 32 51 206 159 173 172
     95 207 174 2422
37  150 DATA 98 207 32 51 206 16
    9 174 172 96 207 174 97 207
    32 51 206 2179
82  160 DATA 172 95 207 200 169
    158 174 97 207 32 51 206 174
     98 207 32 2316
58  170 DATA 51 206 174 99 207 2
    40 6 174 99 207 32 51 206 17
    4 100 207 2233
30  180 DATA 240 1 42 51 206 200
```

```
    204 96 207 208 219 172 95 2
    07 174 97 2411
B9  190 DATA 207 232 169 221 172
     95 207 32 51 206 172 96 207
    32 51 206 2356
99  200 DATA 232 236 98 207 208
    238 173 99 207 240 19 169 17
    1 172 95 207 2771
F3  210 DATA 174 99 207 32 51 20
    6 169 179 172 96 207 32 51 2
    06 173 100 2154
26  220 DATA 207 240 19 169 171
    172 95 207 174 100 207 32 51
     206 169 179 2398
C5  230 DATA 172 96 207 32 51 20
    6 234 169 19 32 210 255 174
    102 207 142 2308
D4  240 DATA 134 2 96 72 24 32 2
    40 255 104 32 210 255 96 32
    155 183 1932
71  250 DATA 142 93 207 32 155 1
    83 172 95 207 24 32 240 255
    96 32 155 2122
E6  260 DATA 183 142 94 207 32 1
    55 183 173 94 207 232 142 89
     207 141 90 2371
65  270 DATA 207 174 134 2 142 1
    01 207 169 0 141 91 207 160
    24 169 0 1928
7C  280 DATA 153 64 207 136 16 2
    48 32 34 207 32 228 255 240
    251 141 92 2336
3C  290 DATA 207 201 20 208 41 1
    73 91 207 201 0 240 237 206
    91 207 172 2502
9B  300 DATA 91 207 169 0 153 64
     207 32 58 207 169 32 32 210
     255 32 1918
AE  310 DATA 58 207 32 58 207 32
     34 207 32 58 207 76 19 207
    173 91 1698
BD  320 DATA 207 24 105 1 205 89
     207 208 14 173 92 207 201 1
    3 240 7 1993
B0  330 DATA 201 20 240 3 76 121
     206 173 92 207 201 13 208 1
    5 32 58 1866
C1  340 DATA 207 169 32 32 210 2
    55 174 101 207 142 134 2 96
    24 173 90 2048
D8  350 DATA 207 201 1 240 17 17
    3 92 207 201 32 144 141 173
    92 207 201 2328
8C  360 DATA 157 176 44 76 1 207
     173 92 207 201 48 144 34 20
    1 58 176 1995
4E  370 DATA 30 32 58 207 173 92
     207 32 210 255 172 91 207 1
    53 64 207 2190
82  380 DATA 238 91 207 173 91 2
    07 205 89 207 208 1 96 76 11
    8 206 76 2289
45  390 DATA 121 206 169 154 32
    210 255 174 105 207 142 134
    2 173 106 207 2387
22  400 DATA 32 210 255 174 104
    207 142 134 2 96 169 157 32
    210 255 96 2275
C8  410 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
36  420 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
3C  430 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
2A  440 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
10  450 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
1E  460 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0 0
04  470 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0 0
72  480 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
F0  490 DATA 0 205 0 0 0 0 0 0 0
     0 0 0 0 0 0 0 205
66  500 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
6C  510 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
59  520 DATA 0 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0
05  530 PRINT "[DOWN2]PRESS ANY
    KEY TO SAVE MACHINE CODE"
D6  540 GETK$:IFK$="" THEN 540
58  550 POKE43,0:POKE44,205:POKE
    45,0:POKE46,208:CLR:SAVE"BOX
     UTILS",8
24  560 REM ** CHANGE 8 TO 1 I
    F USING CASSETTE **
```

PROGRAM BOX DEMO

```
D1  1000 :
FC  1010 F=F+1
50  1020 IFF=1THENLOAD"BOX UTILS
    ",8,1
48  1030 PRINT"[CLR]"
D2  1040 CO=52480    REM CONFIG
05  1050 BO=52517    REM BOX
12  1060 AT=52797    REM PRINT AT

1C  1070 IN=52814    REM INPUT RO
    UTINE
06  1080 :
56  1090 GOTO1150
6A  1100 :
AB  1110 SYSAT,8,24:PRINT"[RVSOF
    F C7]PRESS A KEY TO CONTINUE"

4D  1120 GETA$:IFA$="" THEN1120
E0  1130 RETURN
42  1140 :
10  1150 SYSCO,6,6,1,4,7,ASC("[C
    F]")
27  1160 SYSBO,5,35,4,6,0,0,1,0
A1  1170 SYSAT,12,6:PRINT"[C7]WE
    LCOME TO BOXES"
90  1180 GOSUB1110
E8  1190 PRINT"[CLR]"
16  1200 SYSBO,0,39,0,23,0,0,14,
    1
48  1210 SYSAT,3,5
45  1220 PRINT"[C7]BOXES PROVIDE
    S THE BASIC PROGRAMMER"
A7  1230 PRINT"[RVSON RIGHT3]WIT
    H SEVERAL FUNCTIONS"
45  1240 PRINT
22  1250 PRINT"[RIGHT3 RVSON]CON
    FIG"
F7  1260 PRINT"[RIGHT3 RVSON]AT"

3F  1270 PRINT"[RIGHT3 RVSON]DRA
    W BOX"
CF  1280 PRINT"[RIGHT3 RVSON]INP
    UT"
83  1290 GOSUB1110
53  1300 PRINT"[CLR]"
00  1310 SYSBO,0,39,0,10,0,0,14,
    0
18  1320 SYSAT,1,1
14  1330 PRINT"[RIGHT WHITE]AT [
    C7] THIS ALLOWS THE CURSOR T
    O BE"
BF  1340 PRINT"[RIGHT5]PLACED ON
     THE SCREEN"
07  1350 PRINT"[RIGHT5 DOWN RIGH
    T3]USING COORDINATES X Y"
B3  1360 PRINT"[RIGHT5]THIS IS U
    SEFUL IF YOU REQUIRE"
F4  1370 PRINT"[RIGHT5]EXTENSIVE
     CURSOR MOVEMENT"
65  1380 GOSUB1110
71  1390 PRINT"[CLR]"
89  1400 SYSBO,0,39,0,20,0,0,14,
    0
A3  1410 PRINT"[HOME DOWN RIGHT
    WHITE]BOX DRAW[C7] THIS ALLO
    WS DISPLAY OF BOXES"
3D  1420 SYSAT,1,2:PRINT"ON THE
    COMMODORE SCREEN"
90  1430 SYSAT,1,4:PRINT"CARE SH
    OULD BE TAKEN NOT TO USE THE"

9D  1440 SYSAT,1,5:PRINT"BOTTOM
    RIGHT CHARACTER ON THE SCREE
    N"
9D  1450 SYSAT,1,7:PRINT"BOXES C
    AN BY DRAWN BE SPECIFYING"
B7  1460 SYSAT,1,9:PRINT"START X
     END X START Y END Y"
62  2470 SYSAT,1,10:PRINT"NEXT
    2 VERTICAL BARS MAY BE PLACE
    D ON"
95  1480 SYSAT,1,11:PRINT"THESE
    ARE SHOWN IN B1 AND B2"
4E  1490 SYSAT,1,12:PRINT"THE NE
    XT PARAMETER  C1 IS THE COLO
    R"
D8  1500 PRINT"[RIGHT]FINALLY  T
    HE LAST FLAG IS SET"
8C  1510 PRINT"[RIGHT]1 INDICATE
    S A REVERSE BOX"
CC  1520 PRINT"[RIGHT]ANY OTHER
    INDICATES A NORMAL FRAME"
F3  1530 GOSUB1110
EE  1540 PRINT"[CLR]HERE ARE THE
     TWO TYPES OF BOXES"
7D  1550 SYSBO,5,35,5,10,0,0,14,
    0
6D  1560 SYSBO,5,35,11,16,0,0,14
    ,1
31  1570 SYSAT,6,8:PRINT"[RVSOFF
    ]NORMAL"
11  1580 SYSAT,6,12:PRINT"[RVSON
    ]REVERSE"
34  1590 GOSUB1110
84  1600 PRINT"[CLR]"
4C  1610 SYSBO,1,19,0,3,0,0,1,0
DF  1620 SYSBO,20,38,0,3,0,0,2,0

02  1630 SYSBO,1,19,4,7,0,0,3,0
9D  1640 SYSBO,20,38,4,7,0,0,4,0

AD  1650 SYSBO,1,19,8,11,0,0,5,0

DE  1660 SYSBO,20,38,8,11,0,0,6,
    0
8A  1670 SYSBO,1,19,12,15,0,0,7,
    0
0B  1680 SYSBO,20,38,12,15,0,0,8
    ,0
90  1690 SYSBO,1,19,16,19,0,0,9,
    0
BE  1700 SYSBO,20,38,16,19,0,0,1
    0,0
69  1710 SYSBO,1,19,20,23,0,0,11,
    0
6A  1720 SYSBO,20,38,20,23,0,0,1
    2,0
4E  1730 GOSUB1110
20  1740 PRINT"[CLR]"
19  1750 SYSBO,1,19,0,3,0,0,1,1
02  1760 SYSBO,20,38,0,3,0,0,2,1

0F  1770 SYSBO,1,19,4,7,0,0,3,1
2A  1780 SYSBO,20,38,4,7,0,0,4,1
0D  1790 SYSBO,1,19,8,11,0,0,5,1

40  1800 SYSBO,20,38,8,11,0,0,6,
    1
90  1810 SYSBO,1,19,12,15,0,0,7,
    1
B8  1820 SYSBO,20,38,12,15,0,0,8,
    1
9E  1830 SYSBO,1,19,16,19,0,0,9,
    1
```

```
[illegible] [illegible] [illegible] 1 [illegible]
     1
[illegible] 1[illegible] [illegible] 1 [illegible]
     1
[illegible] 1[illegible] SYSB3 [illegible] 0 [illegible]
     1
[illegible] 1[illegible] GOSUB1110
[illegible] [illegible] PRINT [CLR]
[illegible] 1[illegible] SYSAT 15 0 PRINT [illegible]
     NPUT
[illegible] 1[illegible] PRINT [DOWN] [illegible]PLEA
     SE ENTER A WORD
[illegible] 1[illegible] SYSIN 0 1[illegible]
[illegible] 1[illegible] A$=
[illegible] 1[illegible] FORL=0TO[illegible]
[illegible] [illegible] A$=A$+CHR$(PEEK[illegible]+L
     )
[illegible] 1[illegible] NEXTL
[illegible] 1[illegible] B$=A$
[illegible] 1[illegible]0 PRINT [illegible]PLEASE ENT
     ER A NUMBER
[illegible] 1[illegible] SYSIN 1 10
[illegible] 1[illegible] A$=
[illegible] [illegible]0 FORL=0TO[illegible] A$=A$+CHR$(PE
     EK([illegible]+L)) NEXTL
[illegible] [illegible]0 SYSAT 0 10
[illegible] [illegible] PRINT [C7]WORD TYPED
     [WHITE] B$
[illegible] [illegible] PRINT [C7]NUMBER TYPED
     [WHITE] VAL(A$)
[illegible] [illegible] [illegible]B1110
[illegible] [illegible] PRINT [CLR]
[illegible] [illegible] [illegible]PT=1
[illegible] [illegible] [illegible] [illegible] 34 1 5 0 0 1 1
EE [illegible] [illegible]AT 16 2 PRINT [WHITE
     ][illegible]
BA 20[illegible] [illegible]AT 10 3 PRINT [RVSON
     ]USE [illegible] UP AND DOWN
87 2100 SYSAT 12 4 PRINT [RVSON
     ]RETURN TO FINISH
45 2110 SYSBO 10 30 10 12 0 0 1
     1
30 2120 SYSBO 10 30 13 15 0 0 1
     4 1
8D 2130 SYSBO 10 30 16 18 0 0 1
     4 1
34 2140 SYSBO 10 30 19 21 0 0 1
     4 1
A5 2150 GETA$ IFA$=  THEN2150
[illegible] 2160 IFA$=CHR$(13)THENGOTO23
     00
E9 2170 IFA$= [DOWN] ANDOPT=4TH
     ENOPT=1 GOTO2190
3F 2180 IFA$= [DOWN] THENOPT=OP
     T+1
F[illegible] 2190 IFA$= [UP] ANDOPT=1THEN
     OPT=4 GOTO2210
5A 2200 IFA$= [UP] THENOPT=OPT
     1
[illegible] 2210 SYSBO 10 30 10 12 0 0 1
     4 1
11 2220 SYSBO 10 30 13 15 0 0 1
     4 1
[illegible] 2230 SYSBO 10 30 16 18 0 0 1
     4 1
[illegible] [illegible]40 SYSBO 10 30 19 21 0 0 1
     4 1
41 2250 IFOP=1THENSYSBO 10 30 1
     [illegible] 0 0 1 1
[illegible] [illegible] IFOP=2THENSYSBO 10 30 1
     3 15 0 0 1 1
[illegible] [illegible] IFOP=3THENSYSBO 10 30 1
     6 18 0 0 1 1
[illegible] 2280 IFOP=4THENSYSBO 10 30 1
     [illegible]21 0 0 1 1
[illegible] [illegible] [illegible]TO2[illegible]0
4F [illegible]0 PRINT [CLR]
[illegible] [illegible]10 [illegible] 1 19 1 10 0 0 14
     [illegible]
[illegible] [illegible] [illegible] 1 19 11 20 13 18
     4 1
4B [illegible] [illegible] 2[illegible] 38 1 10 0 0 14
     1
[illegible] [illegible] [illegible] 2[illegible] 38 11 20 13 18
     14 1
38 235[illegible] [illegible]
8[illegible] [illegible]36 PRI[illegible] 1 [illegible]
[illegible] 2370 [illegible]
E[illegible] 2380 PRINT [illegible] TT
     - JUNE 1[illegible]
DF 2390 END
```

FILE EXTENSION

PR[illegible]

```
0 DIMB$(25[illegible] PRINT [illegible]
WHT]INSERT DI[illegible] RET
URN POKE53[illegible]
1 GETA$ IFA$[illegible] 1[illegible]THEN1 [illegible]
[illegible]
2 M=1 OPEN4 4[illegible]
PUT#15 [illegible] THEN[illegible]
3 PRINT [CLR][illegible] P[illegible]
 F3RT=1TO[illegible] RE[illegible] NEXT
OPEN[illegible] 8 0 $
4 FORT=[illegible] T#5 A$ NEXT
5 GET#5 A$ IF[illegible]THEN9
6 IFA$ [illegible]HR$(34)THEN5
7 FORT=1TO21 GET#[illegible] A$ B$(N)=B$(N
)+A$ IFA$=CHR$(34)THEN[illegible](N)=T
8 NEXT PRINTCHR$(34)B$(N) N=N+1
GETA$ IFA$<> THEN4
9 PRINT (CLR)(YEL)FILE NAME (WHT
) CHR$(34)B$(M) (DOWN)(DOWN) FO
RT=1TO3 PRINT (YEL)(DOWN (LEFT)
T (WHT) A$(T) NEXT
10 PRINT (DOWN)(YEL)-(WHT) SCRAT
CH(DOWN) PRINT (YEL)@ (WHT)DISK
 COMMAND(DOWN) PRINT (YEL)S (WH
T)DISK STATUS CLOSE5
11 P$=
   PRINT (DOWN)(YEL)R (WHT)RENAM
E PRINT (DOWN)(YEL)P (WHT)HARD
COPY
12 GETA$ PRINT (HOME) TAB(11)B$(
M) IFA$= (DOWN) ANDM<N 1THENM=M+
1 GOTO12
13 IFA$= (UP) ANDM>1THENM=M-1 GO
TO12
14 IFA$=  THEN12
15 IFA$= (CLR) THENM=N 1
16 IFA$= (HOME) THENM=1
17 IFA$= S THENPRINT (HOME)(DOWN
)(DOWN) P$ INPUT#15 W X$ Y Z PRI
NT (UP) W X$Y Z:GOTO12
18 IFA$= @ THENINPUT (CLR)(YEL)C
OMMAND(WHT) A$ PRINT#15 A$ GOTO
9
19 IFA$= P THENPRINT#4 (RVS)
FORT=0TON 1 PRINT#4 CHR$(34)B$(T
) NEXT
20 IFB$(M)=P$THEN12
21 IFA$= - THENPRINT#15 S +LEF
T$(B$(M) B(M)-1) B$(M)=P$
22 IFA$= R THENC$=LEFT$(B$(M) B(
M)-1) D$=RIGHT$(B$(M) 3) GOTO25
23 A=VAL(A$) IFA>0ANDA<4THENC$=L
EFT$(B$(M) B(M)-1) D$=RIGHT$(B$(
M) 3) GOTO26
24 IFA$=  THENRUN
25 GOTO12
26 IFLEN(C$)+LEN(F$(A))>15THEN1[illegible]
27 PRINT#15 R C$ C$(A) = C$
E$=C$+CHR$(34)+A$(A)
28 B$(M)=LEFT$(E$+P$ 18)+D$ GOTO
12
29 PRINT (CLR)(YEL)OLD FILE NAME
 = (WHT) C$ PRINTTAB(16) (BLU)(D
[illegible]N)(D[illegible]N) [illegible]WN[illegible]
(UP)(UP)
30 INPUT (YEL)NEW FILE NAME (WHT
) Z$ IFZ$= THEN9
31 B$(M)=LEFT$((Z$)+CHR$(34)+P$
18)+D$
32 PRINT#15 R Z$ = C$:B(M)=LEN
(Z$)+1 Z$= GOTO9
```

HI-RES COLOUR PLOTTER

[illegible]

```
[illegible] 10 [illegible]175STEP16 [illegible]
     [illegible]
[illegible] [illegible] READC POKEA+B
     [illegible] D=1+ [illegible]NEXT
[illegible] 30 READCH IF[illegible] THENPRINT C
     HECKSUM ERROR IN LINE PEEK(6
     3)+256*PEEK(64 END
[illegible] 40 NEXT [illegible]176 96 END
E8 500 DATA3[illegible] 25[illegible] 174 32 235 18
     3 165 21 141 [illegible] 196 240 10 20
     1 2 176 206[illegible]
20 501 DATA1[illegible] 16[illegible] 2[illegible] 201 64 176
     9 165 20 141 [illegible] 196 224 200
     144 3 1744
B6 502 DATA[illegible]6 72 176 142 3 196
     3[illegible] 165 194 [illegible]2 63 193 72 174
     8 196 1796
F5 503 DATA[illegible] 119 166 254 208
     16 1 251 129 251 104 169 4 3
     2 148 1[illegible]3 [illegible]
9b 504 DATA1[illegible] [illegible] 196 129 251 96
     [illegible]174 8 196 224 1 208 36 202
     73 2[illegible] 2[illegible]9
[illegible] 505 DATA3[illegible] 251 129 251 104 7
     4 1 251 129 251 169 4 32 148
     19[illegible] 173 2193
64 506 DATA[illegible] 196 10 10 10 10 13
     3 2[illegible]3 161 251 41 1[illegible] 5 [illegible] 12
     9 251 17[illegible]
B[illegible] 507 DATA96 224 2 208 [illegible]9 162
     0 1 251 129 251 104 74 73 25
     5 33 1692
E1 508 DATA251 129 251 169 4 32
     148 19[illegible] 161 251 41 240 13 7
     196 129 2215
A4 509 DATA251 96 162 0 1 251 1
     29 251 104 74 [illegible] 251 129 251
     169 [illegible] 16 2336
63 510 DATA32 148 193 173 7 196
     129 251 96 73 255 33 251 12
     9 251 104 [illegible]321
[illegible]A 511 DATA164 254 240 7 74 73
     255 33 251 129 251 96 32 253
     174 32 2318
DB 512 DATA235 183 165 21 141 2
     196 240 10 201 2 176 15 165
     20 201 1973
EE 513 DATA64 176 9 165 20 141
     1 196 224 200 144 3 76 72 17
     6 142 1811
4A 514 DATA3 196 32 63 193 166
     254 208 16 33 251 141 16 196
     169 4 1941
A7 515 DATA32 148 193 161 251 1
     41 17 196 96 72 16[illegible] 0 33 251
     208 2[illegible] 1989
E5 516 DATA104 74 33 251 141 16
     196 208 4 141 17 196 96 169
     4 32 1682
```

```
98  517 DATA148 193 161 251 74 7
    4 74 74 141 17 196 96 141 16
    13F 164 1956
FC  518 DATA24 33 251 208 13 169
    4 32 148 193 161 251 41 15
    141 17 1751
CE  519 DATA196 96 164 216 32 14
    8 193 161 251 41 15 141 17 1
    96 76 169 3 [illegible]
F3  520 DATA0 173 251 164 32 193
    252 172 1 196 41 248 24 101
    251 133 1778
FA  521 DATA251 168 252 109 2 19
    6 133 252 173 3 196 41 248 1
    33 254 162 [illegible]
DF  522 DATA5 [illegible] 173 162 3 3
    2 277 147 173 1 196 41 7 101
    7 1 17[illegible]
9C  523 DATA123 251 144 2 237 25
    2 173 1 196 41 7 168 254 240
    2 41 71 [illegible]
5B  524 DATA6 133 252 76 164 7 2
    29 253 160 169 1 274 0 43 3
    13 1274
32  525 DATA252 3 8 252 96 133 2
    52 169 0 133 251 173 1 196
    4 74 74 2268
EA  526 DATA174 2 196 240 2 9 3
    24 101 251 133 251 144 3 23
    0 252 2044
EA  527 DATA24 173 3 196 41 248
    133 253 162 2 32 200 193 165
    253 101 2179
FA  528 DATA251 133 251 144 2 23
    0 252 96 164 0 141 15 196 16
    5 254 10 2309
EB  529 DATA46 15 196 202 208 24
    9 101 251 129 251 168 252 10
    9 15 196 133 2522
FB  530 DATA252 96 32 253 174 32
    235 183 169 20 141 1 196 16
    5 21 141 2 [illegible]
37  531 DATA2 196 142 3 196 32 2
    53 174 32 237 183 165 20 141
    4 196 1974
F0  532 DATA165 1 141 5 196 142
    6 196 32 165 194 24 173 1 1
    96 141 1798
42  533 DATA12 196 109 4 196 141
    9 196 173 2 196 141 13 196
    109 5 1698
B9  534 DATA196 141 10 196 240 1
    1 201 2 176 23 173 9 196 201
    64 176 2015
3F  535 DATA16 173 3 196 141 14
    1 4 109 6 196 141 11 196 201
    200 144 1943
EB  536 DATA3 76 72 178 22 41 17
    2 173 1 196 205 9 196 208 8
    173 1763
BF  537 DATA 196 207 11 196 240
    10 238 1 196 208 3 238 2 19
    6 206 2149
CF  538 DATA227 32 41 192 173 7
    196 205 11 196 240 5 238 3 1
    96 206 2166
6E  539 DATA240 32 41 192 173 1
    196 205 12 196 208 8 173 2 1
    96 205 2080
6E  540 DATA13 196 240 15 206 1
    196 174 1 196 201 255 208 22
    7 206 2 2436
89  541 DATA198 240 222 32 41 19
    2 173 3 196 205 14 198 240 6
    206 3 2162
5D  542 DATA196 76 147 194 96 32
    241 183 165 254 240 4 224 1
    6 176 20 2264
7A  543 DATA142 7 196 32 241 183
    165 254 240 6 224 4 144 9 1
    76 4 2027
66  544 DATA224 2 144 3 76 72 17
    8 142 8 196 96 169 0 133 251
    168 1682
97  545 DATA169 32 133 252 152 1
    6 31 4 251 136 208 251 23
    0 252 202 208 2814
9E  546 DATA246 160 64 136 145 2
    51 208 251 96 173 24 208 9 8
    141 24 2144
E6  547 DATA 16 173 17 208 9 32
    141 17 208 165 54 240 8 173
    22 208 2083
3A  548 DATA4 16 141 22 208 96 1
    73 24 2 0 41 247 141 24 206
    173 17 1748
B6  549 DATA 8 41 223 141 17 2
    8 173 22 208 41 239 141 22 2
    08 96 32 2020
8E  550 DATA241 183 165 254 240
    4 224 16 176 4 134 253 42 64
    1 183 224 2579
C8  551 DATA16 144 3 76 72 178 1
    42 32 208 165 253 166 254 2
    0 4 141 2094
04  552 DATA33 208 96 162 250 20
    2 157 0 4 157 250 4 157 244
    5 157 2086
4A  553 DATA238 6 238 241 96 32
    241 183 224 1 240 7 224 8 24
    0 3 2192
E9  554 DATA76 72 178 169 1 160
    255 32 186 208 165 157 240 1
    96 169 2212
E4  555 DATA28 141 136 2 169 13
    42 210 255 169 64 141 52 3
    169 80 1664
64  556 DATA141 25 3 164 73 141
    254 3 169 67 141 255 3 169
    4 162 2067
87  557 DATA232 16 3 32 189 255
    169 1 145 251 169 32 133 25
    2 169 21 2457
82  558 DATA 6 64 160 63 32 216
    255 169 0 32 189 255 169 4
    133 252 2155
7A  559 DATA269 251 168 243 160
    7 32 216 255 168 2 4 240 13
    189 216 145 2674
DF  560 DATA252 154 251 162 232
    160 219 32 216 255 169 4 13
    136 2 96 2494
60  561 DATA 2 241 18 224 1 240
    7 224 8 240 3 76 72 178 169
    1 1899
5D  562 DATA168,32 186 255 165 1
    57 240 1 96,32 189 255 165 2
    165 254 2359
E1  563 DATA240 1 232 134 253 8
    253 169 0 32 213 255 198 253
    208 247 2694
```

```
PROGRAM  PLOT64 DEMO
```

```
42  10 DEFFNA(X)=INT(RND(1)*X)
8D  20 POKE254 1 SYS49867 SYS498
    97 SYS49951 0 0 SYS49834 0 0
    319 199 1 1 PL=49152
69  30 FORZ=1TO100
81  40 SYSPL FNA(320) FNA(200) 1
    1
62  50 NEXT C=9
E1  60 FORP=0TO3 IFP=1THENC=14
DC  70 XC=180 60*P YC=110 40*P S
    =35-15*P
FE  80 FORK=-STOS
0A  90 X=SQR(S*S-K*K) X2=2*X
2A  100 SYSPL XC-X-1 YC-K 1
80  110 FORL=-XTOXSTEP.5 PD=1
93  120 IFFNA(X2) X -LTHENPD=0
77  130 SYSPL XC+L YC-K C PD
3D  140 NEXTL K P
95  150 GOTO150
```

CONSTRUCT A COMPILER

```
PROGRAM  CODEGEN
```

```
FB  10 GOSUB 150
40  20 IF DE% THEN PRINT  [SD]IS
    K [SF]ILE ERROR' [SA]BORTING
    [SC]ODEGEN  END
8C  30 GOSUB 780
7C  40 IF DE% THEN PRINT  [SD]IS
    K [SF]ILE ERROR' [SA]BORTING
    [SC]ODEGEN  END
08  50
59  60 GOSUB 1090
E1  70 IF VT%>1 THEN GOSUB 1880
EA  80 IF TT%>1 THEN GOSUB 2150
F8  90 GOSUB 2330
5E  100
28  110 PRINT#3 CHR$(0) CHR$(0)

3C  120 CLOSE 3 CLOSE 2 PRINT  [
    SS]TARTING ASSEMBLER    CLR
    LOAD ASSEMBLE  8 1
88  130
B6  140
CF  150 REM ********************
    ***********
08  160 REM SETUP THE SYSTEM FOR
     CODEGEN
D8  170 REM ********************
    ***********
8E  180
94  190 PRINT  [CLR SF SC SL] [S
    C]OMPILER [SS]YSTEM [SV]ERSI
    ON 1 0
4D  200 PRINT  [SC]CODEGEN [SV]1
    0[SB]
20  210 PRINT  [SC]OMMODORE 64 [
    SV]ERSION
7E  220 PRINT  [SS]TEVE [SC]ARRI
    E 1988[DOWN2]
DA  230 DIM SL$(200)
D0  240 GOSUB 320
39  250 GOSUB 420 IF DE% THEN RE
    TURN
58  260 GOSUB 590 IF DE% THEN RE
    TURN
35  270
23  280
AD  290 RETURN
17  300 :
0C  310
C1  320 REM ********************
    ***********
FE  330 REM GET FILENAME
D0  340 REM ********************
    ***********
65  350
21  360 F$=
30  370 INPUT  [SF]ILENAME ;F$
A5  380 IF F$=   THEN 370
D9  390 RETURN
AB  400
A1  410
20  420 REM ********************
    ***********
CE  430 REM READ IN SYM FILE
2C  440 REM ********************
    ***********
F9  450
F8  460 OPEN 2 8 2 F$+  SYM S R

58  470 IF DS OR ST THEN DE%= 1
    RETURN
6A  480 INPUT#2 VT%
51  490 IF VT%=1 THEN CLOSE 2 RE
    TURN
71  495 IF ST THEN CLOSE 2 DE%=
    1 RETURN
```

```
62  500 DIM VN$(VT%+1) VT%(VT%+1
    ) VV%(VT%+1)
8E  510 PRINT  [DOWN SR]EADING [
    SV]AR[ABLES
A1  520 FOR V=1 TO VT%-1
EF  530     INPUT#2 VN$(V) VT%(V)
    VV%(V)
9C  540 NEXT
9A  550 CLOSE 2
8C  560 RETURN
06  570
7C  580
FF  590 REM ********************
    **********
39  600 REM READ LITERALS
CB  610 REM ********************
    **********
54  620
70  630 OPEN 2 8 2 F$+  LTR S R

FA  640 IF DS OR ST THEN DE%=-1:
    RETURN
63  650 INPUT#2 TT%
E6  660 IF TT%=1 THEN CLOSE 2 RE
    TURN
5C  665 IF ST THEN DE%= 1 RETURN

83  670 DIM LT$(TT%+1) L%(TT%+1)

6D  680 PRINT '[SR]EADING LITERA
    LS
18  690 FOR LT=1 TO TT% 1
32  700     INPUT#2 LE% L%(LT)=LE
    %
3C  710     LT$=
55  720     IF LE%<>0 THEN FOR Y=
    1 TO LE% GET#2 A$ LT$(LT)=LT
    $(LT)+A$ NEXT
5E  730 NEXT
54  740 CLOSE 2
7E  750 RETURN
C0  760
3F  770
36  780 REM ********************
    **********
8C  790 REM OPEN WORK FILES
62  800 REM ********************
    **********
17  810
3F  820 OPEN 2 8 2 F$+  SFC S R

3D  830 IF DS OR ST THEN DE%=-1
    RETURN
71  840
D2  850 OPEN 3 8 3  @0  +F$+  AS
    M F W
3F  860 IF DS OR ST THEN DE%=-1
    CLOSE2 RETURN
2Y  870 PRINT#3 CHR$(1) CHR$(8)

FD  880 RETURN
47  890
BD  900
14  910 REM ********************
    **********
A0  920 REM OUTPUT ASM LINE
20  930 REM ********************
    **********
55  940
E8  950 PRINT#3 CHR$(255) CHR$(0
    ) CHR$(0) CHR$(0) OL$ CHR$(0
    )
D3  960 TL=TL+1 PRINT TL  [LEFT]
    LINES [SPC5]  PRINT [UP]
43  970 RETURN
ED  980
DB  990
1A  1000 REM *******************
    ************
50  1010 REM OUTPUT LIBRARY CALL
    LINE
26  1020 REM *******************
    ************
30  1030 :
81  1040 GOSUB 910
4A  1050 OL$=  JSR SYSLIB"
19  1060 GOTO 910
0B  1070
06  1080
7F  1090 REM *******************
    ************
58  1100 REM GENERATE PROGRAM HE
    ADER
BB  1110 REM *******************
    ************
5E  1120
E2  1130 PRINT  [SG]ENERATING [S
    P]ROGRAM [SH]EADER "
3B  1140 OL$= , [SC]ODEGEN [SV]1
    0[SB]  GOSUB 910
BE  1150 OL$=   [SC]64 [SV]ERSIO
    N  GOSUB 910
C7  1160 OL$=    GOSUB 910
8D  1170 OL$=  ORG $0801  GOSUB
    910
24  1180 OL$=  BABIC  GOSUB 910
9E  1190 OL$=  BYT $0C $08 $0A $
    00 $9E $20 $32  GOSUB 910
28  1200 OL$=  BYT $30 $36 $33 $
    00 $00 $00 $00  GOSUB 910
EA  1210 OL$=  JSR LOADLIB  GOSU
    B 910
BC  1220 OL$=  JMP MAINSTART  GO
    SUB 910
E1  1230 OL$=    GOSUB 910
96  1240 OL$=   ***** PROGRAM VA
    RIABLES *****  GOSUB 910
7C  1250 OL$=  AC1 EQZ $03  GOSU
    B 910
51  1260 OL$=  AC2 EQZ $05 :GOSU
    B 910
C8  1270 OL$=  SD1 EQZ $26 ':GOSU
    B 910
FF  1280 OL$=  SD2 EQZ $3F :GOSU
    B 910
E1  1290 OL$=  UP1 EQZ $FB  GOSU
    B 910
C0  1300 OL$=  UP2 EQZ $FD  GOSU
    B 910
CH  1310 OL$=  AFT EQZ $45  GOSU
    B 910
6B  1320 OL$=  TT1 EQZ $47  GOSU
    B 910
B3  1330 OL$=  SYSLIB EQZ $5E  G
    OSUB 910
9E  1340 OL$=    GOSUB 910
18  1350 OL$='  LOADLIB  GOSUB 91
    0
33  1360 OL$=  LDA #2  GOSUB 910

50  1370 OL$=  LDY #1  GOSUB 910

92  1380 OL$=  LDX #8  GOSUB 910

E3  1390 OL$=  JSR $FFBA" GOSUB
    910
C7  1400 OL$=  LDA #6  GOSUB 910

EB  1410 OL$=  LDX #<SYSLIBNAME
    GOSUB 910
56  1420 OL$=  LDY #>SYSLIBNAME
    GOSUB 910
F6  1430 OL$=  JSR $FFBD  GOSUB
    910
8D  1440 OL$=  LDA #0  GOSUB 910
92  1450 OL$=  TAX  GOSUB 910
DC  1460 OL$=  LDY #$C0 :GOSUB 9
    10
E5  1470 OL$=  JSR $FFD5  GOSUB
    910
5E  1480 OL$=  BCS LDERR  GOSUB
    910
33  1490 OL$=  JMP $C000  GOSUB
    910
32  1500 OL$=  LDERR  GOSUB 910
C9  1510 OL$=  LDA #<LDERRM  GOS
    UB 910
6E  1520 OL$=  STA TT1  GOSUB 91
    0
27  1530 OL$='  LDA #>LDERRM  GOS
    UB 910
AB  1540 OL$=  STA TT1+1 :GOSUB
    910
A6  1550 OL$=  LDY #0  GOSUB 910

AD  1560 OL$=  LDERRLP' GOSUB 91
    0
C0  1570 OL$=  LDA (TT1) Y  GOSU
    B 910
ED  1580 OL$=  BEQ LDERREXIT  GO
    SUB 910
83  1590 OL$=  JSR $FFD2  GOSUB
    910
10  1600 OL$=  INY  GOSUB 910
F0  1610 OL$=  BNE LDERRLP  GOSU
    B 910
C3  1620 OL$=  LDERREXIT  GOSUB
    910
39  1630 OL$=  LDX #$80  GOSUB 9
    10
49  1640 OL$=  JMP ($0300)  GOSU
    B 910
B8  1650 OL$=    GOSUB 910
67  1660 OL$=  SYSLIBNAME  GOSUB
    910
F7  1670 OL$='  BYT  SYSLIB  :GOS
    UB 910
D0  1680 OL$=  LDERRM  GOSUB 910

23  1690 OL$=  BYT  [SL]IBRARY [
    SF]ILE [SN]OT [SF]OUND   13
    GOSUB 910
51  1700 OL$=  BYT  [SR]UN [SA]B
    ORTED   13 0  GOSUB 910
3A  1710 RETURN
84  1720 :
F2  1730
39  1740 REM *******************
    ************
E1  1750 REM READ LINE FROM SFC
    FILE
35  1760 REM *******************
    ************
CA  1770
CE  1780 OC$=
8D  1790 INPUT#2 SL
3A  1800 FOR X=1 TO SL
89  1810     A$=   GET#2 A$:A$=A$
    +CHR$(0)
E3  1820 :   SF=ST
B2  1830     OC$=OC$+LEFT$(A$ 1)
85  1840 NEXT
CF  1850 RETURN
71  1860
6F  1870
AC  1880 REM *******************
    ************
53  1890 REM PROCESS VARIABLE TA
    BLE
98  1900 REM *******************
    ************
47  1910
15  1920 OL$= , ****** VARIABLES
    ******  GOSUB 910
03  1930 PT%=1
CB  1940 PRINT '[SG]ENERATING [S
    V]ARIABLES
5E  1950 IF VT%(PT%)=1 THEN OL$=
      +VN$(PT%)+  WOR 0  GOSUB
    910
F7  1960 IF VT%(PT%)=2 THEN OL$=
      +VN$(PT%)+  BYT 0 0 0  GO
    SUB 910
35  1970 IF VT%(PT%)=3 THEN GOSU
    B 2050
A6  1980 IF VT%(PT%)=4 THEN GOSU
    B 2100
89  1990 PT%=PT%+1
6F  2000 IF PT%<VT% THEN 1950
FE  2010 OL$=    GOSUB 910
65  2020 RETURN
CF  2030
C5  2040
6C  2050 OL$=   +VN$(PT%)+  WOR
    +STR$(VV%(PT%)) GOSUB 910
```

```
8C  2060 OL$= RES +STR$(2*VV%(P
    T%)) GOSUB 910
90  2070 RETURN
12  2080
0B  2090
D6  2100 OL$=  +VN$(PT%)+  WOR
    +STR$(VV%(PT%)) GOSUB 910
14  2110 OL$= RES +STR$(4*VV%(P
    T%)) GOSUB 910
DE  2120 RETURN
60  2130
5E  2140
BD  2150 REM *******************
    ***********
20  2160 REM PROCESS LITERALS
E9  2170 REM *******************
    ***********
B6  2180
C3  2190 LG=0
22  2200 PT%=1
41  2210 PRINT  (SG)ENERATING (5
    L)ITERALS
29  2220 OL$=  ***** LITERALS *
    ****  GOSUB 910
07  2230 L$=STR$(LG) LB$= LIT +R
    IGHT$(L$ LEN(L$) 1)
6D  2240 OL$=  +LB$+  BYT +STR$
    (L%(PT%)) GOSUB 910
C%  2250 IF L%(PT%)>0 THEN OL$=
     BYT  +LT$(PT%)+   GOSUB 9
    10
92  2260 LT$(PT%)=LB$
92  2270 PT%=PT%+1 LG=LG+1
8C  2280 IF PT%<TT% THEN 2230
39  2290 OL$= ; GOSUB 910
8A  2300 RETURN
35  2310
23  2320 :
48  2330 REM *******************
    ***********
CB  2340 REM PROCESS SFC FILE
44  2350 REM *******************
    ***********
7B  2360 :
59  2370 SB%=0 MR%=0:SP%=0 CS=0
D7  2380 PRINT  (SG)ENERATING CO
    DE
C5  2390 GOSUB 1780 REM READ LIN
    E FROM FILE
39  2400 GOSUB 2450 REM PROCESS
    LINE
6F  2410 IF SF=0 THEN GOTO 2390
F3  2420 RETURN
BD  2430
AB  2440
E0  2450 REM *******************
    ***********
87  2460 REM PROCESS LINE FROM S
    FC FILE
FC  2470 REM *******************
    ***********
83  2480
9C  2490 LP%=0
F8  2500 LP%=LP%+1
6F  2510 IF LP%>LEN(OC$) THEN RE
    TURN
ED  2520 CC%=ASC(MID$(OC$ LP% 1)
    )
86  2530 IF CC%>127 THEN 2630
CF  2540
9D  2550 REM ***** CODES 1-33 **
    ***
30  2560
0E  2570 ON CC% GOSUB 2970 3100
    3180 3260 3380 3500 3610 374
    0 3810
2F  2580 IF CC%>9 THEN ON CC%-9
    GOSUB 3890 4030 4170 2830 43
    50 4360,4350 4590 4600
D7  2590 IF CC%>18 THEN ON CC%-1
    8 GOSUB 4610 4620 4630 4640
    4670 4670 4670 4670 4670
4C  2600 IF CC%>27 THEN ON CC% 2
    7 GOSUB 4670 4670 4980 4990
    5000 5010
5C  2610 GOTO 2500
7C  2620 :
72  2630 REM ***** CODES 128 / *
    ****
60  2640
D8  2650 REM 128-138
F6  2660 ON CC%-127 GOSUB 5040 2
    830 2830 2830 2830 5170 5180
     5210 5320 5440 5550
C6  2670 REM 139-146
AC  2680 IF CC%>138 THEN ON CC%
    138 GOSUB 5660 5750 5880 603
    0 6040 6070,6200 2830
DC  2690 REM 147-154
A9  2700 IF CC%>146 THEN ON CC%-
    146 GOSUB 6210 6220 2830 283
    0 6250 6430 6340 2830
8A  2710 REM 155-162
3F  2720 IF CC%>154 THEN ON CC%-
    154 GOSUB 2830 6550 6560 657
    0 6580 6590 6600 6610
18  2730 REM 163 170
B4  2740 IF CC%>162 THEN ON CC%-
    162 GOSUB 6620 6630 6640 665
    0 6660 6670 6680 6630
37  2750 REM 171-178
28  2760 IF CC%>170 THEN ON CC%-
    170 GOSUB 6700 6710 6720 673
    0 6740 6750 6760 6770
A2  2770 REM 179-186
EC  2780 IF CC%>178 THEN ON CC%-
    178 GOSUB 6780 6790 6800 681
    0 6820 6830 6840 6850
39  2790 REM 187-191
31  2800 IF CC%>186 THEN ON CC%-
    186 GOSUB 6860 6870 6880 689
    0 6900
14  2810 GOTO 2500
35  2820
73  2830 PRINT CC%  (SN)OT IMPLE
    MENTED
AD  2840 RETURN
17  2850 :
0D  2860
EE  2870 REM *******************
    ***********
58  2880 REM GET ADDRESS FROM LI
    NE
FA  2890 REM *******************
    ***********
65  2900
81  2910 LP%=LP%+1 AD=ASC(MID$(O
    C$ LP% 1))
D9  2920 LP%=LP%+1 AD=AD+256*ASC
    (MID$(OC$ LP% 1))
F3  2930 RETURN
BD  2940
AB  2950
E0  2960 REM *******************
    ***********
0A  2970 REM *******************
    ***********
D3  2980 REM CODE 1  LOAD AC2 IM
    M
06  2990 REM *******************
    ***********
F9  3000
D8  3010 LP%=LP%+1 LO%=ASC(MID$(
    OC$ LP% 1)) LO$=STR$(LO%)
0C  3020 LP%=LP%+1 HI%=ASC(MID$(
    OC$ LP% 1)) HI$=STR$(HI%)
C9  3030 OL$=  LDA # +RIGHT$(LO$
    ,LEN(LO$) 1) GOSUB 910
EA  3040 OL$=  LDX # +RIGHT$(HI$
     LEN(HI$) 1) GOSUB 910
B1  3050 OL$=  STA AC2  GOSUB 91
    0
98  3060 OL$=  STX AC2+1  GOSUB
    910
87  3070 RETURN
2E  3080
24  3090
B7  3100 REM *******************
    ***********
6E  3110 REM CODE 2  STACK AC2
B3  3120 REM *******************
    ***********
7C  3130
66  3140 OL$=  LDA #$01   GOSUB 1
    040
04  3150 RETURN
5E  3160
54  3170
C7  3180 REM *******************
    ***********
3F  3190 REM CODE 3  UNSTACK AC1

D3  3200 REM *******************
    ***********
AC  3210 :
D7  3220 OL$=  LDA #$02  GOSUB 1
    040
24  3230 RETURN
8E  3240
84  3250
17  3260 REM *******************
    ***********
01  3270 REM CODE 4  SAVE AC2 AT
     ADDR
63  3280 REM *******************
    ***********
DC  3290
00  3300 GOSUB 2870
55  3310 OL$=  LDA AC2  GOSUB 91
    0
18  3320 OL$=  LDX AC2+1  GOSUB
    910
FD  3330 OL$=  STA  +VN$(AD) GOS
    UB 910
86  3340 OL$=  STX  +VN$(AD)+ +1
     GOSUB 910
AD  3350 RETURN
17  3360 :
0D  3370
EE  3380 REM *******************
    ***********
0D  3390 REM CODE 5  LOAD AC2 FR
    OM ADDR
FA  3400 REM *******************
    ***********
65  3410
89  3420 GOSUB 2870
2C  3430 OL$=  LDA  +VN$(AD):GOS
    UB 910
93  3440 OL$=  LDX  +VN$(AD)+ +1
     GOSUB 910
47  3450 OL$=  STA AC2  GOSUB 91
    0
16  3460 OL$=  STA AC2+1 :GOSUB
    910
15  3470 RETURN
8F  3480
95  3490 :
06  3500 REM *******************
    ***********
15  3510 REM CODE 6 INCREMENT IM
    MEDIATE
12  3520 REM *******************
    ***********
ED  3530
F1  3540 GOSUB 2870
07  3550 OL$=  INC  +VN$(AD) GOS
    UB 910
53  3560 OL$=  BNE 3  GOSUB 910
11  3570 OL$=  INC  +VN$(AD)+ +1
     GOSUB 910
87  3580 RETURN
2E  3590
24  3600
B7  3610 REM *******************
    ***********
E9  3620 REM CODE 7 DECREMENT IM
    MEDIATE
63  3630 REM *******************
    ***********
7C  3640
60  3650 GOSUB 2870
CC  3660 OL$=  DEC  +VN$(AD) GOS
    UB 910
4D  3670 OL$=  LDA  +VN$(AD) GOS
```

```
    UB 910
D5  3680 OL$=  CMP #$FF  GOSUB 9
    10
EE  3690 OL$=  BNE 3  GOSUB 910
6E  3700 OL$=  DEC  +VN$(AD)+ +1
     GOSUB 910
02  3710 RETURN
AC  3720 :
9A  3730
F1  3740 REM ********************
    ***********
02  3750 REM CODE 8  MOVE AC2 TO
     UP1
CD  3760 REM ********************
    ***********
F2  3770
5E  3780 OL$=  LDA #$03  GOSUB 1
    040
52  3790 RETURN
DC  3800
5F  3810 REM ********************
    ***********
5C  3820 REM CODE 9  MOVE AC2 TO
     UP2
A8  3830 REM ********************
    ***********
35  3840 :
D4  3850 OL$=  LDA #$04  GOSUB 1
    040
AD  3860 RETURN
17  3870
00  3880
EE  3890 REM ********************
    ***********
FC  3900 REM CODE 10  LOAD SD2 I
    MM
FA  3910 REM ********************
    ***********
65  3920
F9  3930 GOSUB 2870
C8  3940 OL$=  LDA  +LT$(AD) GOS
    UB 910
CE  3950 OL$=  LDX #< +LT$(AD)+
    +1  GOSUB 910
41  3960 OL$=  LDY #> +LT$(AD)+
    +1  GOSUB 910
D6  3970 OL$=  STA SD2 :GOSUB 91
    0
0F  3980 OL$=  STX SD2+1  GOSUB
    910
E5  3990 OL$=  STY SD2+2  GOSUB
    910
21  4000 RETURN
83  4010
F9  4020
12  4030 REM ********************
    ***********
5A  4040 REM CODE 11 SAVE SD2 AD
    DR
4E  4050 REM ********************
    ***********
D1  4060
05  4070 GOSUB 2870
B8  4080 OL$=  LDA SD2  GOSUB 91
    0
74  4090 OL$=  LDX SD2+1  GOSUB
    910
43  4100 OL$=  LDY SD2+2  GOSUB
    910
0E  4110 OL$=  STA  +VN$(AD) GOS
    UB 910
19  4120 OL$=  STX  +VN$(AD)+ +1
     GOSUB 910
7F  4130 OL$=  STY  +VN$(AD)+ +2
     :GOSUB 910
82  4140 RETURN
7C  4150
6A  4160 :
A1  4170 REM ********************
    ***********
5F  4180 REM CODE 12 LOAD SD2 AD
    DR
B0  4190 REM ********************
    ***********
42  4200
```

```
92  4210 GOSUB 2870
05  4220 OL$=  LDA  +VN$(AD) GOS
    UB 910
2A  4230 OL$=  LDX  +VN$(AD)+ +1
     GOSUB 910
24  4240 OL$=  LDY  +VN$(AD)+ +2
     GOSUB 910
D1  4250 OL$=  STA SD2  GOSUB 91
    0
3E  4260 OL$=  STX SD2+1  GOSUB
    910
C8  4270 OL$=  STY SD2+2 :GOSUB
    910
46  4280 RETURN
E8  4290 :
E6  4300
3F  4310 REM ********************
    ***********
50  4320 REM CODES 14 & 15 STACK
    /UNST SD
01  4330 REM ********************
    ***********
3E  4340
0C  4350 OL$=  LDA #$05  GOTO 10
    40
D6  4360 OL$=  LDA #$06  GOTO 10
    40
19  4370
17  4380
44  4390 REM ********************
    ***********
76  4400 REM CODE 16  STRING OP
    PREFIX
50  4410 REM ********************
    ***********
6F  4420 :
28  4430 LP%=LP%+1 C%=ASC(MID$(O
    C$ LP% 1))
38  4440 IF C%=164 THEN OL$=  LD
    A #$07
F6  4450 IF C%=165 THEN OL$=  LD
    A #$08
9C  4460 IF C%=166 THEN OL$=  LD
    A #$09
61  4470 IF C%=167 THEN OL$=  LD
    A #$0A
99  4480 IF C%=168 THEN OL$=  LD
    A #$0B
45  4490 IF C%=169 THEN OL$=  LD
    A #$0C
F8  4500 IF C%=170 THEN OL$=  LD
    A #$0D
C7  4510 GOSUB 1040
37  4520 RETURN
F9  4530
F7  4540 :
24  4550 REM ********************
    ***********
5F  4560 REM CODES 17-22
30  4570 REM ********************
    ***********
CF  4580
17  4590 OL$=  LDA #$0E :GOTO 10
    40
F6  4600 OL$=  LDA #$0F :GOTO 10
    40
70  4610 OL$=  LDA #$10 :GOTO 10
    40
28  4620 OL$=  LDA #$11 :GOTO 10
    40
0A  4630 OL$=  LDA #$12  GOTO 10
    40
75  4640 OL$=  LDA #$13  GOTO 10
    40
06  4650
7C  4660
FF  4670 REM ********************
    ***********
10  4680 REM CODES 23-26 / 28 29

C8  4690 REM ********************
    ***********
54  4700
97  4710 GOSUB 2880
5A  4720 OL$=  LDA #< +VN$(AD):G
```

```
    OSUB 910
81  4730 OL$=  LDX #> +VN$(AD) G
    OSUB 910
59  4740 OL$=  STA TT1  GOSUB 91
    0
46  4750 OL$=  STX TT1+1  GOSUB
    910
26  4760 OL$=  LDA #$14  GOSUB 1
    040
33  4770 IF CC%<=24 OR CC%>=28 T
    HEN OL$=  LDA #$15  GOSUB 10
    40
C8  4780 IF CC%=25 OR CC%=26 THE
    N OL$=  LDA #$16  GOSUB 1040
E5  4790 IF CC%=23 THEN OL$=  LD
    A #$17  GOTO 1040
50  4800 IF CC%=24 THEN OL$=  LD
    A #$18  GOTO 1040
71  4810 IF CC%=25 THEN OL$=  LD
    A #$19  GOTO 1040
42  4820 IF CC%=26 THEN OL$=  LD
    A #$1A  GOTO 1040
D5  4830 IF CC%=28 THEN OL$=  LD
    A #$1B  GOTO 1040
30  4840 OL$=  LDA #$1C  GOTO 10
    40
3E  4850
34  4860 :
A6  4870 REM ********************
    ***********
04  4880 REM CODE 27  UNSTACK AR
    RAY PTR
84  4890 REM ********************
    ***********
00  4900
59  4910 OL$=  LDA #$1D  GOTO 10
    40
71  4920
6F  4930
AC  4940 REM ********************
    ***********
E9  4950 REM CODES 30-32
98  4960 REM ********************
    ***********
47  4970
A4  4980 OL$=  LDA #$1E  GOTO 10
    40
BF  4990 OL$=  LDA #$1F :GOTO 10
    40
FD  5000 OL$=  LDA #$20 :GOTO 10
    40
A8  5010 OL$=  LDA #$40 :GOTO 10
    40
95  5020
83  5030
28  5040 REM ********************
    ***********
12  5050 REM ********************
    ***********
97  5060 REM CODE 128  END
4E  5070 REM ********************
    ***********
D1  5080
14  5090 IF SB% THEN SB%=0 OL$=
     RTS  GOTO 910
5E  5100 OL$=  LDA #$4E  GOTO 10
    40
33  5110 :
2E  5120
6D  5130 REM ********************
    ***********
D1  5140 REM CODES 133-134 BSET/
    WSET
59  5150 REM ********************
06  5160
02  5170 OL$=  LDA #$21  GOTO 10
    40
F9  5180 OL$=  LDA #$22  GOTO 10
    40
8D  5190
5E  5200
30  5210 REM ********************
    ***********
AF  5220 REM CODE 135  LOOP
E9  5230 REM ********************
```

```
       ***********
B6  5240
FF  5250 SP%=SP%+1
5B  5260 CN$=STR$(CS) CS=CS+1
E7  5270 SL$(SP%)= CTL +RIGHT$(C
    N$ LEN(CN$)-1)
CC  5280 OL$=   +SL$ SP%  GOSUB
    910
30  5290 RETURN
F2  5300
E8  5310
63  5320 REM ******************
    ***********
33  5330 REM CODE 136  ENDLOOP
5F  5340 REM ******************
    ***********
C0  5350
CD  5360 CN$=SL$(SP%) SP%=SP% 1
D3  5370 NC%=ASC(MID$(OC$ LP%+1
    1)+CHR$(0))
A1  5380 IF NC%<>0 THEN RETURN
F9  5390 OL$=  JMP  +CN$ GOSUB 9
    10
25  5400 OL$=   +CN$+ EX  GOSUB
    910
B9  5410 RETURN
7B  5420
71  5430 :
FA  5440 REM ******************
    ***********
9F  5450 REM CODE 137  WHILE
F6  5460 REM ******************
    ***********
49  5470
DB  5480 CN$=SL$(SP%)+ EX
C7  5490 OL$=  LDA #$23  GOSUB 1
    040
C7  5500 OL$=  BNE 3  GOSUB 910
11  5510 OL$=  JMP  +CN$ GOSUB 9
    10
2B  5520 RETURN
95  5530 :
F3  5540
2B  5550 REM ******************
    ***********
03  5560 REM CODE 138  WHEN
24  5570 REM ******************
    ***********
DB  5580
E3  5590 OL$=  LDA #$23  GOSUB 1
    040
53  5600 OL$=  BNE 3  GOSUB 910
A5  5610 OL$=  JMP  +CN$:GOSUB 9
    10
19  5620 OL$=   +CN$+ EX  GOSUB
    910
90  5630 RETURN
24  5640 :
12  5650
59  5660 REM ******************
    ***********
02  5670 REM CODE 139  IF
55  5680 REM ******************
    ***********
8A  5690
A3  5700 SP%=SP%+1
E5  5710 IN$=STR$(CS) CS=CS+1
AB  5720 SL$(SP%)= CTL +RIGHT$(I
    N$ LEN(IN$)-1)
72  5730 OL$=  LDA #$23  GOSUB 1
    040
5C  5740 OL$=  BNE 3  GOSUB 910
B9  5750 OL$=  JMP  +SL$(SP%) GO
    SUB 910
18  5760 RETURN
9A  5770
9C  5780 :
1B  5790 REM ******************
    ***********
8F  5800 REM CODE 140  ENDIF
17  5810 REM ******************
    ***********
E8  5820
D4  5830 OL$=   +SL$(SP%) GOSUB
    910
AE  5840 SP%=SP% 1
7E  5850 RETURN
C0  5860
3E  5870
1D  5880 REM ******************
    ***********
3C  5890 REM CODE 141  ELSE
48  5900 REM ******************
    ***********
17  5910
A8  5920 IN$=SL$(SP%)
5D  5930 SL$(SP%)=IN$+ EX
EA  5940 OL$=  JMP  +SL$(SP%) GO
    SUB 910
EA  5950 OL$=   +IN$ GOSUB 910
D1  5960 RETURN
53  5970
49  5980
C2  5990 REM ******************
    ***********
29  6000 REM CODES 142-143 CHARO
    UT/FOPEN
3E  6010 REM ******************
    ***********
A1  6020
22  6030 OL$=  LDA #$24  GOTO 10
    40
51  6040 OL$=  LDA #$25  GOTO 10
    40
83  6050 :
F9  6060 :
12  6070 REM ******************
    ***********
9D  6080 REM CODE 144  BEGIN
4E  6090 REM ******************
    ***********
D1  6100 :
83  6110 IF SB% THEN RETURN
E4  6120 OL$=  MAINSTART  GOSUB
    910
87  6130 RETURN
29  6140
24  6150 :
B7  6160 REM ******************
    ***********
4A  6170 REM CODES 145/ 147-148
83  6180 REM ******************
    ***********
7C  6190
F5  6200 OL$=  LDA #$26  GOTO 10
    40
C8  6210 OL$=  LDA #$27 :GOTO 10
    40
FF  6220 OL$=  LDA #$28 :GOTO 10
    40
54  6230
42  6240 :
E9  6250 REM ******************
    ***********
D7  6260 REM CODE 151 SUBROUTINE

E5  6270 REM ******************
    ***********
9A  6280 :
0E  6290 GOSUB 2870:SB%=-1
FC  6300 OL$=   +VN$(AD) GOSUB 9
    10
30  6310 RETURN
F2  6320
E8  6330
63  6340 REM ******************
    ***********
C5  6350 REM CODE 153  CALL
5F  6360 REM ******************
    ***********
C0  6370
14  6380 GOSUB 2870
88  6390 OL$=  JSR  +VN$(AD) GOS
    UB 910
97  6400 RETURN
15  6410
17  6420
44  6430 REM ******************
    ***********
73  6440 REM CODE 152  RETURN
50  6450 REM ******************
    ***********
8F  6460
8A  6470 OL$=  RTS  GOSUB  1
E7  6480 RETURN
49  6490
47  6500
94  6510 REM ******************
    ***********
56  6520 REM CODES 156-191
E0  6530 REM ******************
    ***********
9F  6540
6D  6550 OL$=  LDA #$29 :GOTO 10
    40
CB  6560 OL$=  LDA #$2A :GOTO 10
    40
FE  6570 OL$=  LDA #$2B  GOTO 10
    40
45  6580 OL$=  LDA #$2C  GOTO 10
    40
98  6590 OL$=  LDA #$2D  GOTO 10
    40
3F  6600 OL$=  LDA #$2E  GOTO 10
    40
32  6610 OL$=  LDA #$2F  GOTO 10
    40
97  6620 OL$=  LDA #$30  GOTO 10
    40
4A  6630 OL$=  LDA #$31  GOTO 10
    40
21  6640 OL$=  LDA #$32  GOTO 10
    40
14  6650 OL$=  LDA #$33  GOTO 10
    40
20  6660 OL$=  LDA #$34 :GOTO 10
    40
07  6670 OL$=  LDA #$35 :GOTO 10
    40
7A  6680 OL$=  LDA #$36' GOTO 10
    40
01  6690 OL$=  LDA #$37  GOTO 10
    40
14  6700 OL$=  LDA #$38  GOTO 10
    40
FB  6710 OL$=  LDA #$39  GOTO 10
    40
C1  6720 OL$=  LDA #$3A  GOTO 10
    40
CC  6730 OL$=  LDA #$3B  GOTO 10
    40
AB  6740 OL$=  LDA #$3C  GOTO 10
    40
06  6750 OL$=  LDA #$3D  GOTO 10
    40
35  6760 OL$=  LDA #$3E  GOTO 10
    40
80  6770 OL$=  LDA #$3F  GOTO 10
    40
37  6780 OL$=  LDA #$40  GOTO 10
    40
D6  6790 OL$=  LDA #$41  GOTO 10
    40
B9  6800 OL$='  LDA #$42  GOTO 10
    40
E6  6810 OL$=  LDA #$43  GOTO 10
    40
8A  6820 OL$=  LDA #$44  GOTO 10
    40
6A  6830 OL$=  LDA #$45  GOTO 10
    40
2D  6840 OL$=  LDA #$46  GOTO 10
    40
FC  6850 OL$=  LDA #$47  GOTO 10
    40
7F  6860 OL$=  LDA #$48  GOTO 10
    40
DE  6870 OL$=  LDA #$49  GOTO 10
    40
3F  6880 OL$=  LDA #$4A  GOTO 10
    40
13  6890 OL$=  LDA #$4B :GOTO 10
    40
0A  6900 OL$=  LDA #$4C :GOTO 10
    40
```

Listings

PROGRAM ASSEMBLE LDR

```
D9  10 IF PEEK(44)=8 THEN PRINT
     CHANGE START OF BASIC FIRST
    ''  END
AF  15 AD=2049
E3  20 FOR LN=100 TO 2430 STEP 1
    0
A3  25    RT=0
91  30    FOR OS=0 TO 15
C2  35       READ BY POKE AD+OS
    BY
4D  40       RT=RT+BY
[illegible]  45    NEXT
DC  50    READ TT IF TT<>RT THEN
     PRINT  ERROR IN LINE  LN EN
    D
2A  55    AD=AD+16
FE  60 NEXT
FE  65 PRINT  SAVING  ASSEMBLE

33  70 HI=INT(AD/256) LO=AD HI*2
    56
1E  75 POKE 43 1:POKE 44 8 POKE
    45 LO POKE 46 HI SAVE ASSEMB
    LE  8
CC  80 CLR
6F  85
60  90
61  100 DATA 12 8 10 0 158 32 50
     48 54 51 0 0 0 0 76 33  532
0F  110 DATA 0 [illegible] 0 0 0
     0 0 [illegible]
0B  120 DATA 0 [illegible] 0 0
     0 0 [illegible]
F1  130 DATA [illegible] 0 0 0
     0 0 0 0 [illegible]
FF  140 DATA [illegible] 0 0 0
     0 0 0 0
05  150 DATA [illegible] 0 0
     0 0 0 [illegible]
53  160 DATA [illegible] 0 0
     0 0 0 0 0 0 0
93  170 DATA 0 0 [illegible] 0
     0 [illegible] 0
67  180 DATA 0 [illegible] 0 0 0 0
     0 0 0 0 0
0F  190 DATA [illegible]
     0 [illegible]
7B  200 DATA 0 0 0 [illegible] 0
     0 0 0 0 [illegible]
41  210 DATA [illegible] 0 0 0 0
     0 0 0 0 0 0
4F  220 DATA [illegible] 0 0 0
     0 0 0 0 0 0 0
95  230 DATA [illegible] 0 0
     0 0 0 0 0 0
A3  240 DATA 0 [illegible]
     0 0 0 0 0 0
A9  250 DATA 3 [illegible] 0 0
     0 0 0 0 0 0
76  260 DATA 0 [illegible] 0
     0 0 0 0 0 0
7C  270 DATA [illegible]
     0 0 0 0 0 0
8A  280 DATA [illegible] 0 0
     0 0 0 0 0
03  290 DATA 0 0 0 0 0 46 69 89
     69 44 0 41 87 46 65 83  721
A   300 DATA 7 64 48 58 13 197
     78 84 69 82 32 198 73 76 69
     79  1296
71  310 DATA 65 77 69 32 40 46 6
     9 83 77 41 58 0 13 206 79 32
      983
C   320 DATA 70 73 76 69 78 65 7
     7 69 32 71 73 86 69 78 58 32
      1077
E0  330 DATA 193 66 79 82 84 74
     78 71 13 0 13 138 73 76 69 7
     8  1248
6F  340 DATA 65 77 69 32 84 79 7
     9 32 76 79 78 71 59 32 208 7
     6  1196
FF  350 DATA 69 65 83 69 32 212
     82 89 32 65 71 65 73 78 13 0
      1098
F9  360 DATA 14 147 13 198 195 2
     04 32 193 83 83 69 77 66 76
     69 82  1601
68  370 DATA 46 13 214 69 82 83
     73 79 78 32 49 46 49 47 56 5
     6  1072
9F  380 DATA 13 211 84 69 86 69
     32 195 65 82 82 73 69 32 49
     57  1258
91  390 DATA 56 56 13 0 13 13 19
     3 83 83 69 77 66 76 69 82 32
      981
33  400 DATA 206 65 83 83 32 0 3
     2 66 89 71 73 78 83 46 13 0
      1002
30  410 DATA 13 193 83 83 69 77
     66 76 69 32 67 79 77 80 76 6
     9  1229
34  420 DATA 84 69 46 13 204 79
     65 68 42 65 68 68 82 69 83 8
     3  1178
C7  430 DATA 32 61 36 0 13 197 7
     8 68 32 65 68 68 82 69 83 83
      1035
92  440 DATA 32 32 61 36 0 66 82
     75 0 67 76 67 24 67 76 68
     829
87  450 DATA 216 67 76 73 88 67
     76 86 194 68 69 88 202 68 69
     83  1566
BA  460 DATA 136 73 78 88 232 73
     78 89 200 78 79 80 234 80 7
     2 65  1735
6D  470 DATA 72 80 72 80 8 80 76
     65 114 80 76 80 40 82 84 73
      1152
30  480 DATA 64 82 84 83 96 83 6
     9 67 96 88 69 68 248 83 69 7
     3  1377
29  490 DATA 120 84 65 88 170 84
     69 89 168 84 83 88 186 84 8
     8 69  1611
A1  500 DATA 138 84 88 83 154 84
     89 65 152 66 67 67 144 66 6
     7 83  1497
C6  510 DATA 176 66 69 81 240 66
     77 73 48 66 78 69 208 66 80
     76  1539
E3  520 DATA 16 66 86 67 80 66 8
     6 83 112 65 68 67 0 65 78 68
      1073
68  530 DATA 11 65 89 76 22 66 7
     3 84 36 67 7 8 44 67 83 82
      1016
B3  540 DATA 55 67 80 89 66 68 6
     9 67 77 69 79 82 88 73 78 67
      1174
8B  550 DATA 96 74 77 80 110 74
     83 82 121 76 68 65 132 76 68
     [illegible]  1373
FF  560 DATA 143 76 68 89 154 76
     83 82 165 79 82 65 176 82 7
     9 76  1575
29  570 DATA 187 82 79 82 198 83
     66 67 209 83 84 65 220 87 8
     4 68  1760
EE  580 DATA 231 83 84 89 243 66
     89 84 0 67 79 82 1 69 31 90
      1457
E5  590 DATA 2 69 81 65 3 79 82
     71 4 82 68 83 5 255 106 101
      1156
6B  600 DATA 117 255 109 175 121
     97 113 255 255 41 37 53 255
     45 61 57  1996
87  610 DATA 33 42 255 17 255 6
     22 255 14 30 255 255 255 255
     255 255  2459
37  620 DATA 36 255 255 44 255 2
     55 255 255 255 255 201 197 2
     13 255 205 221  3412
6F  630 DATA 217 193 209 255 255
     224 228 255 255 236 255 255
     255 255 255 255  3857
22  640 DATA 192 196 255 255 204
     255 255 255 255 255 255 255
     196 214 255 206  3766
EA  650 DATA 222 255 255 255 255
     255 73 69 85 255 77 93 80 8
     5 81 255  2639
D0  660 DATA 255 255 230 246 255
     238 254 255 255 255 255 255
     255 255 255 255  4025
F2  670 DATA 76 255 255 255 255
     108 255 255 255 255 255 32 2
     55 255 255 255  3531
07  680 DATA 255 255 169 165 181
     255 173 189 185 164 177 255
     255 162 166 255  3158
B0  690 DATA 162 174 255 190 255
     255 255 255 160 164 186 255
     172 188 255 255  3450
16  700 DATA 255 255 74 255 7 5
     6 255 78 94 255 255 255 255
     255 9 5  2711
F8  710 DATA 21 255 13 23 25 1 1
     7 255 42 255 38 54 255 46 62
     255  1623
CB  720 DATA 255 255 255 106 255
     102 118 255 110 126 255 255
     255 255 255 233  3348
11  730 DATA 229 245 255 237 253
     249 225 241 255 255 255 193
    11 [illegible] 41 15 [illegible]
47  740 DATA [illegible] 14 [illegible] 255
    [illegible] 14 255 255
    255 [illegible] 34 [illegible]
AC  750 DATA [illegible] 148 [illegible] 140
    [illegible] 255 255
    255 [illegible]
DE  760 DATA [illegible] 89 3
    2 [illegible] 32
    10[illegible]
7[illegible] 770 DATA [illegible] 3 [illegible] 7
    3 [illegible]
    17[illegible]1
E8  780 DATA [illegible]
    [illegible] 187 5[illegible]
    [illegible] 13[illegible]
C0  790 DATA [illegible]
    3 [illegible]
    [illegible] 13[illegible]
CD  800 DATA [illegible]
    [illegible] 0 2[illegible] 73 6
    [illegible]
9F  810 DATA [illegible]
    [illegible] 68
    1044
[illegible] 820 DATA [illegible] 85 [illegible] 8[illegible]
    [illegible]
    8[illegible] 1[illegible]
[illegible]F 830 DATA [illegible] 8 6
    5[illegible] 3 [illegible]
    8 [illegible]
[illegible] 840 DATA [illegible]
    [illegible]
    [illegible]
F[illegible] 850 DATA [illegible]
    [illegible] 8 [illegible]
    [illegible]
2[illegible] 860 DATA [illegible] 1 [illegible]
    [illegible] 5[illegible] 4 [illegible]
    [illegible]
34  870 DATA [illegible] 19[illegible]
    [illegible]
    9[illegible] 1[illegible]
D6  880 DATA [illegible] 42 46 0 21
    1 [illegible] 64 8[illegible] 82
    1[illegible]
5C  890 DATA [illegible] 46 0 201 [illegible] 7
    0 [illegible] 95 65 7
    8 [illegible]
17  900 DATA [illegible] 84 89 [illegible] 197
    8 8 [illegible] 7[illegible] 69 7
    1[illegible] 13[illegible]
E8  910 DATA [illegible] 31 19 6[illegible] 68
    8[illegible] 7
    [illegible]
D[illegible] 920 DATA [illegible] 8
    4 [illegible] 32
    [illegible] 134[illegible]
6E  930 DATA [illegible] 88 [illegible] 0 21
    1 [illegible] 44 [illegible]
    1[illegible]4
24  940 DATA [illegible]
    6 46 [illegible] 1 4 9 [illegible]
    11[illegible]
FD  950 DATA [illegible] 59
    1[illegible]
8A  960 DATA 12 [illegible] 1 1[illegible]9
    1 1[illegible] 14
    1[illegible] 13[illegible]
4E  970 DATA [illegible]
    1[illegible] 55 1[illegible] 1
    133 1[illegible]
7F  980 DATA [illegible]
    [illegible]
    6 1[illegible] 5[illegible]1
56  990 DATA [illegible] 24
    96 [illegible]
    0 10[illegible] 4 1[illegible]
96  1000 DATA [illegible]
    0 133 [illegible] 0
    8 23[illegible] [illegible]
9A  1010 DATA [illegible] 190
    13 32 12[illegible] 78
    10 [illegible] 1[illegible]
93  1020 DATA [illegible]
    8 3[illegible] 1[illegible]
    5 104 1[illegible]
D9  1030 DATA 170 [illegible]42 1[illegible] 8 1[illegible] 9
    5 13 168 189 94 1 1[illegible] 75
    5 13 173  1743
D1  1040 DATA 19 8 240 5 169 0 7
    6 209 13 169 2 32 195 255 16
    9 3  1564
E7  1050 DATA 32 195 255 174 18
    8 23[illegible] 23[illegible] 154 162 128 108 0
    3 134 [illegible]0  1855
A4  1060 DATA 132 21 160 3 177 2
    0 [illegible]43 6 32 210 255 200 208 2
    4[illegible] 96 201  220[illegible]
D[illegible] 1070 DATA 65 144 6 201 91 17
    6 [illegible] 56 96 24 98 201 4[illegible] 144 2
    50 [illegible]01  1801
7E  1080 DATA 98 176 246 144 242
    32 1[illegible] 14 176 237 76 28 14 3
    [illegible] [illegible]8 14  1533
[illegible]8 1090 DATA 176 [illegible]29 201 65 144
    22[illegible] 201 [illegible]1 176 223 144 219
    1[illegible]4 [illegible]0 132 [illegible]1  2383
8[illegible] 1100 DATA 16 [illegible]0 177 20 32 21
    0 255 2 0 201 13 208 246 46
    162 98 16[illegible]  2176
[illegible] 1110 DATA 8 76 [illegible]1 14 201 10
    176 3 [illegible] 46 96 10[illegible] 54 96 72 7
    [illegible]  1103
[illegible]5 1120 DATA [illegible]4 74 74 32 65 14
    [illegible] [illegible]10 [illegible]5[illegible] 104 41 15 32 65 1
    4 76 [illegible]2[illegible]
3[illegible] 1130 DATA 210 [illegible]55 165 72 32
    [illegible]5 14 165 71 76 [illegible]5 14 32 115
    [illegible]4 169 [illegible]594
9[illegible] 1140 DATA 32 32 210 255 76 7
    8 1[illegible] 169 38 161 8 133 20 134
    2[illegible] 162  1544
36  1150 DATA 2 32 198 255 32 22
    8 255 141 34 8 32 228 255 14
    1 35 [illegible]  1884
5A  1160 DATA 208 10 17[illegible] 34 8 [illegible]0
    8 5 32 204 255 56 96 32 228
    255 141 [illegible]945
98  1170 DATA 3[illegible] 8 32 228 255 14
    1 37 8 3[illegible] [illegible]28 255 201 0 240
    13 160  1874
F9  1180 DATA 0 145 20 230 20 20
    8 [illegible]41 230 21 76 185 1[illegible] 169 1
    [illegible] 145 [illegible]  1737
2D  1190 DATA 24 96 173 24 8 240
    1 9[illegible] 162 9 76 190 13 169 0
    13[illegible]  1414
F0  1200 DATA 71 133 72 165 45 1
    6[illegible] 46 133 [illegible]3 134 70 160 0 15
    2 14[illegible] 69  1630
A[illegible] 1210 DATA 162 161 160 9 32 2
    55 1[illegible] [illegible]8 169 0 141 230 8 160
    0 32  162[illegible]
6A  1220 DATA 207 255 201 13 240
    6 153 [illegible]31 8 200 208 243 140
    290 8 96  [illegible]439
2[illegible] 1230 DATA 162 69 160 9 32 25
    [illegible] 13 3  249 14 173 230 8 208
    10 16[illegible]  1766
DE  1240 DATA 93 160 9 32 255 13
    7[illegible] [illegible]34 13 201 13 144 10 162
    12[illegible] 160  1698
6[illegible] 1250 DATA 9 32 255 13 76 17
    15 1[illegible]0 8 185 66 9 153 198 8
    200  13[illegible]6
F[illegible] 1260 DATA 192 3 208 [illegible]45 162
    [illegible] 1[illegible]9 [illegible]31 8 15[illegible] 166 8 153 19
    8 8 23[illegible]  216[illegible]
1[illegible] 1270 DATA [illegible]30 236 230 8 208
    240 162 [illegible] 189 54 9 153 198 8
    232 200  2327
81  1280 DATA 224 5 208 244 140
    33 8 174 [illegible]30 8 160 0 185 62
    9 157  1850
85  1290 DATA 166 8 200 232 192
    4 208 244 142 32 8 96 169 2
    168 162  2033
[illegible]1 1300 DATA 8 32 186 255 173 3
    [illegible]
    [illegible]
CC  1310 DATA [illegible] 176 [illegible]
    3 1 [illegible]
    3[illegible] 19[illegible] 25[illegible]  240[illegible]
18  1320 DATA 208 68 32 [illegible]
    3 18[illegible] 2[illegible]5 208 60 3[illegible] [illegible]4 [illegible]
    9[illegible] 1[illegible] 3  [illegible]26[illegible]
43  1330 DATA [illegible]8 162 8 3[illegible] 18[illegible]
    55 1[illegible] [illegible] 162 198 160 [illegible]
    189 2[illegible]  2029
2B  1340 DATA 3[illegible] 192 255 176 [illegible]3
    16[illegible] [illegible] 32 [illegible]01 255 176 26 1[illegible]
    [illegible] 8 3  [illegible]
41  1350 DATA 21[illegible] 2[illegible]5 [illegible] 16[illegible]
    [illegible]8 1[illegible] 1[illegible]3 31 8 [illegible] 21[illegible]
    3[illegible] 1[illegible]3 [illegible]55  2337
18  1360 DATA [illegible]08 4 3[illegible] 204 [illegible]
    [illegible] 204 [illegible]5 169 16 [illegible] 1
    3 1[illegible]  1969
68  1370 DATA [illegible] 9 4[illegible] 141 23[illegible]
    62 [illegible] 160 [illegible] 76 [illegible] 1[illegible]
    [illegible] 20[illegible]  20[illegible]
C8  1380 DATA 2 [illegible] 14[illegible] 1[illegible] 8
    160 3 177 [illegible]51 [illegible] 8 [illegible] 1
    98 [illegible]51  19[illegible]3
C8  1390 DATA 165 251 [illegible]
    8 2 10[illegible] [illegible]5 [illegible] 3[illegible] 15 16 16[illegible]
    0 17[illegible] 1[illegible]  [illegible]71
1C  1400 DATA [illegible] 9 32 [illegible] 17 3[illegible]
    38 14 176 [illegible] 4[illegible] [illegible] 8 [illegible]
    7 231  166[illegible]
89  1410 DATA 8 2[illegible] 2[illegible]8 [illegible] 2
    54 15 32 4 16 [illegible]01 [illegible]40 246
    96 165  2019
95  1420 DATA 45 166 46 133 5 13
    4 8 160 0 1[illegible] 5 208 2 24 96
    205  1412
54  1430 DATA 2[illegible]0 8 208 40 162 0
    200 200 200 200 177 5 221 [illegible]
    31 8 2[illegible]8  2298
9D  1440 DATA 27 232 236 230 8 1
    44 [illegible]42 160 1 177 5 141 22 8
    200 177  2010
4E  1450 DATA 5 141 20 8 200 177
    5 141 21 8 56 96 160 0 177
    5  1220
26  1460 DATA 24 105 4 101 5 133
    5 144 [illegible] 230 8 76 72 16 32 2
    54  1209
D4  1470 DATA 15 32 26 16 173 21
    0 8 208 5 162 4 76 190 13 32
    64  1254
AC  1480 DATA 16 144 12 162 2 17
    3 23 8 201 1 208 5 76 190 13
    162  1396
5D  1490 DATA 0 169 1 141 [illegible]4 8 2
    24 0 240 1 96 160 0 173 230
    8  1475
8C  1500 DATA 145 69 200 169 2 1
    45 69 200 165 71 145 [illegible]9 200
    165 72 145  2031
30  1510 DATA 69 [illegible]0[illegible] 162 0 189 2
    31 8 145 69 23  200 236 [illegible]3
    8 208 244  2431
D3  1520 DATA 1[illegible]2 24 101 69 133
    69 165 70 105 0 1[illegible] 70 [illegible]01 1
    60 208 5  1665
E8  1530 DATA 162 13 76 190 1[illegible] 1
    60 0 152 14[illegible] 69 [illegible] 16[illegible] 3 1[illegible]3
    3 133  1514
2B  1540 DATA 4 32 254 15 32 4[illegible]
    14 176 1 96 [illegible]01 65 176 4 41
    15  1172
82  1550 DATA 144 2 233 55 [illegible]4 6
    3 38 4 176 [illegible]5 [illegible] 3 38 4 17[illegible]
    [illegible]37
F4  1560 DATA 19 [illegible] 3 38 4 1[illegible] 1[illegible]
    6 3 38 4 176 [illegible] 5 3 133  [illegible]34
C4  1570 DATA 3 76 2 17 162 10 7
    6 190 13 169 0 133 3 133 4 3
    2  1023
D4  1580 DATA 15 16 32 254 15 32
    28 14 176 1 96 41 15 72 165
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```
     4  976
F8   1590 DATA [illegible] 2 168 [illegible] 3 76
     4 176 216 6 3 38 4 176 [illegible]
     1196
6D   1600 DATA 24 104 101 3 133 3
     104 105 0 133 4 176 193 6 3
     38  1136
21   1610 DATA 4 176 193 104 24 1
     01 3 133 3 165 4 105 0 133 4
     176  1326
A0   1620 DATA 179 144 191 32 254
     15 133 3 169 0 133 4 32 254
     15 201  1759
6B   1630 DATA 39 240 8 162 8 76
     190 13 76 254 15 76 179 17 1
     73 25  1548
A7   1640 DATA 8 240 36 201 60 24
     0 4 165 4 133 3 169 0 133 4
     76  1476
[illegible] 1650 DATA 200 17 32 4 16 201
     13 240 229 201 40 240 225 2
     01 41 240  2140
EE   1660 DATA 221 201 44 240 217
     208 15 169 1 141 27 8 165 4
     240 5  1906
51   1670 DATA 169 2 141 27 8 96
     201 43 240 4 201 45 208 72 1
     73 26  1656
14   1680 DATA 8 240 5 162 9 76 1
     90 13 238 26 8 165 4 72 165
     3  1384
1C   1690 DATA 72 32 4 16 72 32 2
     54 15 32 156 17 104 201 43 2
     40 24  1314
B    1700 DATA 166 3 164 4 104 13
     3 3 104 133 4 56 128 229 3 1
     33 3  1380
E    1710 DATA 152 229 4 133 4 76
     156 17 24 104 101 3 133 3 1
     04 101  1344
[illegible] 1720 DATA 4 133 4 76 156,17,
     162 0 142 26 8 201 60 240 4
     201  1434
[illegible] 1730 DATA 62 208 6 141 25 8
     32 254 15 201 39 208 5 32 13
     2 17  1386
C4   1740 DATA 76 156 17 32 16 14
     144 54 32 26 16 32 64 16 17
     6 25  886
2F   1750 DATA 169 1 141 25 8 173
     23 8 201 2 208 5 162 1 76 1
     90  1396
8A   1760 DATA 13 169 2 141 27 8
     76 156 17 169 0 173 20 8 133
     3  1115
4A   1770 DATA 173 21 8 133 4 173
     22 8 141 27 8 76 156 17 201
     36  1204
55   1780 DATA 240 4 201 38 208 6
     32 252 16 76 156 17 32 28 1
     4 144  1464
EA   1790 DATA 6 32 58 17 76 156
     17 162 5 76 190 13 173 27 8
     24  1040
A4   1800 DATA 105 1 24 101 71 13
     3 71 169 0 101 72 133 72 173
     23 8  1257
03   1810 DATA 201 2 240 1 96 162
     3 32 201 255 173 29 8 32 21
     0 255  1900
7B   1820 DATA 32 183 255 240 3 7
     6 231 15 172 27 8 240 29 165
     3 32  1711
F0   1830 DATA 210 255 32 183 255
     240 3 76 231 15 136 240 13
     165 4 32  2090
C8   1840 DATA 210 255 32 183 255
     240 3 76 231 15 76 204 255
     141 29 8  2213
60   1850 DATA 169 0 141 27 8 76
     157 16 142 29 8 32 156 17 17
     3 29  1175
D6   1860 DATA 8 201 1 240 58 173
     27 8 201 1 240 51 165 71 24
     137  1574
6B   1870 DATA [illegible] 1 [illegible] 165 72 105 0
     169 165 3 134 3 166 4 132 4
     56  1349
5F   1880 DATA 229 3 133 3 138 22
     9 4 133 4 201 255 240 12 201
     0 208  1993
4A   1890 DATA 22 165 3 201 127 1
     76 15 144 6 165 3 201 128 14
     4 8 169  1678
D8   1900 DATA 1 141 27 8 76 157
     16 162 14 76 190 13 141 29 8
     24  1085
FE   1910 DATA 105 30 133 253 169
     11 105 0 133 254 32 4 16 20
     1 65 208  1719
D7   1920 DATA 24 160 1 177 251 2
     01 13 240 4 201 32 208 12 32
     254 15  1825
A2   1930 DATA 169 0 141 27 8 168
     76 105 20 32 4 16 201 35 20
     8 33  1243
55   1940 DATA 32 254 15 32 156 1
     7 173 28 8,240 5 169 1 141 2
     7 8  1306
3C   1950 DATA 173 27 8 201 1 240
     5 162 10 76 190,13 160 1 76
     105  1448
23   1960 DATA 20 201 40 240 81 3
     2 156 17 173 28 8 240 5 169
     2 141  1553
09   1970 DATA 27 8 173 27 8 201
     1 208 2 160 2 201 2 208 2 16
     0  1390
A5   1980 DATA 5 173 29 8 201 110
     240 4 201 121 208 2 160 5 1
     92 5  1664
47   1990 DATA 208 5 169 2 141 27
     8 32 4 16 201 44 240 3 76 1
     05  1281
4F   2000 DATA 20 32 254 15 201 8
     8,240,10,201 89 240,5 162 12
     76 190  1835
FD   2010 DATA 13 200 200 76 105
     20 32 254 15 32 156 17 32 4
     16 201  1373
8F   2020 DATA 41 240 53 173 28 8
     240 5 169 1 141 27 8 173 27
     8  1342
1D   2030 DATA 201 1 240 5 162 10
     76 190 13 32 4 16 201 44 24
     0 5  1440
E4   2040 DATA 162 9 76 190 13 32
     254 15 201 88 208 244 32 25
     4 15 201  1994
DF   2050 DATA 41 208 237 160 8 7
     6 105 20 32 254 15 201 46 24
     0 10 169  1830
78   2060 DATA 2 141 27 8 160 10
     76 105 20 173 28 8 240 5 169
     1  1173
34   2070 DATA 141,27 8 173 27 8
     201 1 240 5 162 10 76 190 13
     32  1314
96   2080 DATA 254 15 201 89 208
     186 160 9 177 253 201 255 24
     0 6 141 29  2424
93   2090 DATA 8 76 157 18 162 11
     76 190 13 224 56 144 3 76 2
     46 20  1480
FA   2100 DATA 224 33 144 3 76 77
     19 224 25 144 3 76 249 18 7
     6 238  1629
10   2110 DATA 18 169 0 133 71 13
     3 72 32 239 15 32 136 14 8 1
     69 38  1279
74   2120 DATA 162 8 133 251 134
     252 32 15 16 40 144 3 96 173
     28 8  1488
79   2130 DATA 201 2 208 3 32 125
     14 169 0 141 24 8 141 25 8
     141  1242
80   2140 DATA 26 8 141 28 8 32 5
     3 16 201 59 240 206 201 46 2
     08 6  1479
9A   2150 DATA 32 143 16 32 56 16
     2[illegible]1 13 [illegible] 192 3 1[illegible] 14 176
     [illegible]  13[illegible]
1D   2160 DATA 6 [illegible] 13 32 26
     16 32 172 1[illegible] 16 104
     32  888
16   2170 DATA 122 [illegible] 76 155 20 2
     24 56 208 3 76 166 [illegible] 1 224 57
     208 3  1579
0E   2180 DATA 76 181 [illegible] 1 224 48 2
     08 3 76 220 21 [illegible] 59 208 3
     76 8  1666
A9   2190 DATA 22 [illegible] 63 204 [illegible] 76
     32 21 32 56 [illegible] 36 156 17 1[illegible]
     5 3  1173
63   2200 DATA 24 101 71 133 71 1
     65 4 101 72 133 72 173 23 8
     201 2  1354
C2   2210 DATA 240 1 96 162 3 32
     201 255 160 0 166 3 164 4 20
     2 224  1922
3E   2220 DATA 255 208 8 136 192
     255 208 3 76 204 255 32 210
     255 76 63  2446
48   2230 DATA 21 32 56 16 32 156
     17 165 3 166 4 133 71 134 7
     2 141  1219
D1   2240 DATA 30 8 142 31 8,96 3
     2 53 16 32 56 16 201 39 240
     38  1038
0F   2250 DATA 32 156 17 165 4 24
     0 5 162 10 76 190 13 32 111
     22 230  1465
E7   2260 DATA 71 208 2 230 72 32
     56 16 201 44 240 218 201 13
     ,208 1  1813
5F   2270 DATA 96 162 9 76 190,13
     32 254 15 201 39 240 14 133
     3 32  1509
8C   2280 DATA 111 22 230 71 208
     2 230 72 76 151 21 32 254 15
     76 134  1705
40   2290 DATA 21 32 53 16 32 56
     16 32 156 17 32 119 22 165 7
     1 24  864
0F   2300 DATA 105 2 133 71 165 7
     2 105 0 133 72 32 55 16 201
     44 240  1447
D8   2310 DATA 224 201 13 208 1 9
     6 162 9 76 190 13 32 211 14
     165 6  1621
2C   2320 DATA 72 165 5 72 32 156
     17 104 133 5 104 133 6 165
     4 240  1413
18   2330 DATA 5 162 10 76 190 13
     160 1 169 1 145 5 200 165 3
     145  1450
22   2340 DATA 5 200 165 4 145 5
     96 32 211 14 165 5 72 165 6
     72  1342
61   2350 DATA 32 156 17 104 133
     6 104 133 5 160 1 169 2 76 2
     51 21  1370
60   2360 DATA 166 142 18 8 32 22
     2 14 32 17 15 169 1 141 23 8
     32  1060
D5   2370 DATA 125 15 32 146 20 1
     69 2 32 195 255 238 23 8 32
     125 15  1432
E2   2380 DATA 32 175 15 32 146 2
     0 32 77 22 76 234 13 162 241
     160 9  1446
FF   2390 DATA 32 255 13 173 31 8
     32 95 14 173 30 8 32 95 14
     162  1167
A1   2400 DATA 21 160 10 32 255 1
     3 32 115 14 169 13 76 210 25
     5 169 1  1545
8A   2410 DATA 141 27 8 76 124 22
     169 2 141 27 8 173 23 8 201
     2  1192
28   2420 DATA 240 1 96 162 3 32
     201 255 172 27 8 165 3 32 21
     0 255  1562
AA   2430 DATA 136 240 5 165 4 32
     210 255 76 204 255 0 0 0 0
     0  1582
```

MAY I INTERRUPT

```
PROGRAM  MAY 1 INTERRUPT

DB   10 BL=205   LN=50     SA=4915
     2
C0   20 FOR L=0 TO BL CX=0 FOR D=
     0 TO 15:READ A CX=CX+A
B2   25 POKE53280,A POKE SA+L*16+
     D,A NEXT D
A5   30 READ A IF A<>CX THENPRINT
      ERROR IN LINE  LN+(L*10) ST
     OP
10   40 NEXT L SYS524R0
B4   50 DATA 0 0 0 0,0 21 21 21 2
     1 21 21 21 21 23 23 23 237
D6   60 DATA 23 23 23 23 23 25 25
      25 25 25 25 25 25 19 19 19
     372
40   70 DATA 19 19 19 19 19,21 21
      21 21,21 21,21 21,23 23 23
     332
BA   80 DATA 23 23 23,23 23 25,25
     ,25 25,25 25 25 25 19 19 19
     372
D0   90 DATA 19 19 19 19 19 100,1
     00 84 84 100,100 100 100 84
     84 84 1145
C8   100 DATA 84 75 75 75 75 84 8
     4 84 84 75 75 75 75 75 75 75
      1271
E3   110 DATA 75 71,71 71 71 71 7
     1 71 71,67 67 67,67,67 67 67
      1112
07   120 DATA 67 63 63 84 84 67 6
     7 84 84 63 63 63 63,63 63 63
     ,1104
5F   130 DATA 63 63 63 63 63 50 5
     0 42 42 50 50 50 50 47 47 47
      840
59   140 DATA 47 67 67 67 67 63 6
     3 63 63 100 100 100 100 100
     100 100 1267
E5   150 DATA 100 84 84 84 84 84
     84 84 84 84 84,84 84 84,84 8
     4 1440
77   160 DATA 84,75,75 84 84 84 8
     4 84 84 75 75,75 75 75 75 75
      1339
BA   170 DATA 75 79 79 79,79 100
     100 84 84 100 100 100 100 84
      84 84 1445
58   180 DATA 84,79 75 75 75 84 8
     4 84 84 79 75 75 75 75 75 75
     ,1271
33   190 DATA 75 71 71 71 71 71,7
     1 71 71 67 67 67 67 67 67 67
      1112
D7   200 DATA 67 63 63 84,84 67 6
     7 84 84 63 63 63 63 63 63 63
      1104
7B   210 DATA 63 63 63 63 63 42 4
     2 35 35 42 42 42 42 39 39 39
      754
3E   220 DATA 39,39 39 39 39 37 3
     7,31 31 37 37 37 37 35 35 35
     ,584
5E   230 DATA 35,35,35 35,35 33 3
     3 28 28 33 33,33 33 31 31 31
      522
1    240 DATA 31 31 31 31 31 31 3
     9 47 63 84,84 84 84 84 84 84
      923
8    250 DATA 84 84 84 84 84 0 0
     0 0 0 0 0 0 0 0 0 0 420
3    260 DATA 0 0 0 0,0 31 31 31
     31 31 31 31 31 181 181 181 7
     91
5    270 DATA 181 181 181 181 181
      30 30 30 30 30 30 30 30 239
      239 239 1862
2    280 DATA 239 239 239 239 239
      31 31 31 31 31 31 31 31 181
     ,181 181 1986
55   290 DATA 181 181 181 181 181
      30 30 30 30 30 30 30 30 239
      239 239 1862
55   300 DATA 239 239 239 239 239
      121 121 125 125 121 121 121
     ,121 215 215 215 2816
03   310 DATA 215 191,191 191 191
     ,125 125 125 125 69 69 69 69
      69 69 69 1962
8A   320 DATA 69 12 12 12 12 12 1
     2 12,12 15 15 15 15 15 15 15
      270
33   330 DATA 15 75 75 125 125 15
     ,15 125 125 75 75 75 75 75 7
     5 75 1220
DE   340 DATA 75 75 75 75 75 60 6
     0 62 62 60 60 60 60 107 107,
     107 1180
FD   350 DATA 107,15 15 15 15 75
     75 75 75 121 121 121 121 121
     ,121 121 1314
F0   360 DATA 121 215 215 215 215
      215 215 215 215 125 125 125
      125 125 125 125 2716
61   370 DATA 125 191 191 215 215
      125 125 215 215 191 191 191
      191 191 191 191 2954
51   380 DATA 191,191 191 191 191
      121 121 125 125 121 121 121
      121 215 215 215 2576
83   390 DATA 215 191 191 191 191
      125 125 125 125 69 69 69 69
      69 69 69 1962
4A   400 DATA 69 12 12 12 12 12 1
     2 12 12 15 15 15 15 15 15 15
      270
43   410 DATA 15 75 75 125 125 15
      15 125 125 75 75 75 75 75 7
     5 75 1220
62   420 DATA 75 75 75 75 75 62,6
     2 134 134 62,62,62,62 223 22
     3 223 1684
0B   430 DATA 223 223 223 223 223
      162 162 165 165 162 162,162
      162 134 134 134 2815
0A   440 DATA 134,134 134 134 134
      135 135 48 48 135 135 135 1
     35 165 165 165 2073
52   450 DATA 165 165 165 165 165
      165 223 107 75 125 125 125
      125 125 125 125 2270
45   460 DATA 125 125 125 125 125
      0 0 0 0 0 0 0 0 0 0 0 625
63   470 DATA 0 0 0 0 0 17 17 17
      16 0 0 0 0 17,17 17,118
88   480 DATA 16 0,0 0 0 17,17 17
      16 0 0 0 0 17 17 17 134
16   490 DATA 16 0 0 0,0 17 17 17
     ,16 0 0 0 0 17 17 17 134
84   500 DATA 16 0 0 0 0 17 17 17
      16 0 0 0 0 17,17 17 134
16   510 DATA 16 0 0 0 0 17,16 17
      16 17,17 17 16 17 17 17 200
C8   520 DATA 16 17 17 17 16 17 1
     7 17 16 17 16 17 16 17,17 17
      267
7B   530 DATA 16 17 16 17 16 17 1
     7 17 16 17 16 17 16 17 17 17
     ,266
73   540 DATA 16 17 16 17 16 17 1
     6 17 16 17 17 17 16 0 0 0 21
     5
A5   550 DATA 0 0 0 0 0 17 16 17,
     16 17 17 17 16 17 17 17 184
81   560 DATA 16 17 17 17 16 17 1
     7 17 16 17,16 17 16 17 17 17
      267
E3   570 DATA 16 17 16 17 16 17 1
     7,17 16 17,16 17 16 17 17 17
      266
D8   580 DATA 16 17 16 17 16 17,1
     6 17 16 17,17 17 16 0 0 0 21
     5
21   590 DATA 0 0 0 0 0 17 16 17
     16 17 17 17 16 17 17 17 184
53   600 DATA 16 17 17 17 16,17,1
     7 17 16 17 16 17 16 17 17 17
      267
DB   610 DATA 16,17 16 17 16 17 1
     7 17 16 17 16 17 16 17,17 17
      266
43   620 DATA 16 17 16 17,16 17 1
     6 17 16 17 17 17,16 0 0 0 21
     5
D5   630 DATA 0 0 0 0 0 17 16 17
     16 17 17 17 16 17 17 17,184
57   640 DATA 16,0 0 0 0 17 16 17
      16 17 17 17 16 17 17 17 200
CB   650 DATA 16 0 0 0 0 17 16,17
      16 17 17 17 16 17,17 17 200
5E   660 DATA 16 0 0 0 0 17 17 17
      17 17 17 17 17 17 17 17 203
8F   670 DATA 16 0 0,0 0 0 0 0 0
     0 0,0 0 0 0 0,16
39   680 DATA 0 0 0 0 0 0,0 0 0,0
      0 0 0 0 0 0,0
59   690 DATA 84 10 10 10 10 12 1
     2 12 12 10 10 10 10 14 14,14
      254
D7   700 DATA 14 10 10 10 10 14 1
     4 14 14 10 10 10 10 14 14 14
      192
D5   710 DATA 14 10 10 10 10 12 1
     2 12 12 10 10 10 10 14 14 14
      184
C8   720 DATA 14 10 10 10 10 14 1
     4 14 14 10 10 10 10 14 14 14
      192
31   730 DATA 14,10 10 10 10 15 1
     5 15 15 10 10 10 10 16 16 16
     ,202
32   740 DATA 16 10 10 10 10 17 1
     7 17 17 10 10 10 10 18 18 18
      218
31   750 DATA 18,10 10 10 10 21 2
     1 21 21 10 10 10 10,23 23 23
     ,251
1F   760 DATA 23 21 21 21 21 21 2
     1 21 21 21 21 21,21 10 9,8,3
     02
D5   770 DATA 7 7 7 7 7 16 16 16
     16 7 7 7 7 16 16 16 175
B3   780 DATA 16 6 6,6 6 15 15 15
      15 5 5 5 5 14,14 14 162
53   790 DATA 14 11 11 11 11 15 1
     5 15 15 11 11 11,11 17 17,17
      213
B4   800 DATA 17 7 7 7 7 8 8 8 8
     7 7 7 7 7 7 6 125
51   810 DATA 5 5 5 5 5 15 15 15
     15 10 10 10 10 16 16 16 173
80   820 DATA 16 10 10 10,10 17 1
     7 17 17 10 10 10 10 18 18 18
      218
54   830 DATA 18 10,10 10 10 21 2
     1 21 21 10 10 10 10 23 23,23
      251
67   840 DATA 23 21 21 21 21 21 2
     1,21 21 21 21 21 21 25 23 21
     ,344
68   850 DATA 18 17,17 17 17 11 1
     1 11 11 11 11 11 11 23,21 19
      237
AC   860 DATA 17 15 15 15 15 10 1
     0 10 10 10 10 10 10 21 18 17
     ,213
3E   870 DATA 15 14 14 14 14,5 5
     5 5 5 5 5,5 19 16 15 182
36   880 DATA 14 12 12 12 12 11 1
     1 11 11 21,21 21 21 21 21,21
      253
73   890 DATA 21 21,21 21 21 0 0
     0 0 0 0,0 0 0,0 0 105
3E   900 DATA 125 143 143 143 143
     ,143 143 143 143 143 143 143
     143 24 24 24 1913
DE   910 DATA 24 143 143 143 143
     239 239 235 239 143 143 143
     143 24 24 24 2158
9A   920 DATA 24 143 143 143 143
     143 143 143 143 143 143 143
     143 24 24 24 1812
A2   930 DATA 24 143 143 143 143
     239 239 239 239 143 143 143
     143 24 24 24 2196
3A   940 DATA 24 143 143 143 143
     210 210 210 210 143 143 143
     143 195 195 195 2593
45   950 DATA 195 143 143 143 143
     195 195 195 195 143 143 143
     143 209 209 209 2746
13   960 DATA 209 143 143 143 143
     31 31 31 31 143 143 143 143
     181 181 181 2020
C1   970 DATA 181 31 31 31 31 31
     31 31 31 31 31 31 31 143 104
     57 857
52   980 DATA 233 119 119 119 119
     195 195,195 195 12 12 12 12
     195 195 195 2122
8E   990 DATA 195 71 71 71,71,210
     210 210,210 237,237 237 237
     239 239 239 2984
76   1000 DATA 239 218 218 218 21
     8 210 210 210,210 218 218 21
     8 218 195 195 195 3408
F2   1010 DATA 195 233 233 233 23
     3 97 97 97 97 233 233 233 23
     3 233 12 71 2763
8F   1020 DATA 237 71 71 71 71 21
     0 210 210 210 143,143 143 14
     3 195 195 195 2518
02   1030 DATA 195 143 143 143 14
     3 195 195 195 195 143 143,14
     3 143 209 209 209 2746
9C   1040 DATA 209 143 143 143,14
     3 31 31 31 31,143 143 143 14
     3 181 181 181 2020
9B   1050 DATA 181 31 31 31 31 31
     31 31 31 31 31 31 31 30 181
     31 795
40   1060 DATA 209 195 195,195 19
     5 218 218 218 218,218 218 21
     8 218 181 31 239 3184
E8   1070 DATA 195 210 210 210 21
     0 143 143 143 143 143 143 14
     3 143 31 209 195 2614
86   1080 DATA 210 24 24 24 24 10
     4 104 104 104 104 104 104 10
     4 209 195 210 1752
E3   1090 DATA 24 143 143 143 143
     218 218 218 218 31 31 31 31
     31 31 31 1685
FC   1100 DATA 31 31 31 31 31 0 0
     0 0 0 0 0 0 0 0 0 155
87   1110 DATA 0,17,17 17 16 17 1
     7 17 16 17,17,17 16 17,17 17
     252
5F   1120 DATA 16 17 17 17 16 17
     17,17 16 17,17 17,16 17,17 1
     7,268
05   1130 DATA 16 17 17,17 16 17
     17 17 16 17,17 17 16 17 17 1
     7 268
43   1140 DATA 16 17 17 17 16 17
     17 17 16,17 17 17 16 17,17 1
     7 268
9D   1150 DATA 16 17 17 17 16 17
     17 17,16 17 17 17 16 17 17 1
     7 268
17   1160 DATA 16 17 17 17 16 17
     17 17 16 17 17 17 16 17,17 1
     7 268
C1   1170 DATA 16 17 17 17 16 17
     17 17 16 17 17 17 16 17 17 1
     7 268
31   1180 DATA 16 17 17 17 16 17
     17,17 16 17,17 17 16 65 65 6
     5 412
37   1190 DATA 65 65,65,65 64 17
     17 17 16 17 17 17 16 17 17 1
     7 508
EF   1200 DATA 16 17,17,17 16 17
     17 17,16 17 17 17 16 17 17 1
     7 268
59   1210 DATA 16 17 17 17 16 17
     17 17 16 17 17 17 16 17 17 1
     7 268
75   1220 DATA 16 17 17 17 16 17
     17 17 16 17 17 17 16 65 65 6
     5 412
0F   1230 DATA 65 65 65 65 64 17
     17 17 16 17 17 17 16 17 17 1
     7 508
67   1240 DATA 16 17,17 17 16 17
     17 17 16 17 17 17 16 17 17 1
     7 268
51   1250 DATA 16 17 17 17 16 17
     17 17 16 17 17 17 16 17 17 1
     7 268
D1   1260 DATA 16 17,17 17 16 17
     17 17 16 17 17 17 16 65 65 6
     5 412
36   1270 DATA 65 65 65 65 64 17
     17 17 17 17 17 17 16 65 65 6
     5 654
37   1280 DATA 65 65 65 65 64 17
     17 17 17 17 17 17 16 65 65 6
     5 654
F9   1290 DATA 65 65 65 65 64 17
     17 17 17 17 17 17 16 65 65 6
     5 654
35   1300 DATA 65 65 65 65 64 17
     17 17 16 17 17 17 17 17 17 1
     7 510
1E   1310 DATA 16 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0 0 16
8E   1320 DATA 0 0 0 0 0 0 0 0 0 0
     0 0 0 0 0 0 0 0 0
C2   1330 DATA 21 21 21 21 21 15
     15 15 15 15 15,15,15,16 16 1
     6 273
F2   1340 DATA 16 16 16,16 16 17
     17 17 17 17 17 17 17 16 16 1
     6 264
7E   1350 DATA 16 16 16 16 16 15
     15 15 15 15 15 15 15 16 16 1
     6 248
4E   1360 DATA 16 16 16 16 16 17
     17 17 17 17 17 17 17 16 16 1
     6 264
C1   1370 DATA 16 16 16 16 16 12
     12 12 12 12 12 12 12 14 14 1
     4 218
0C   1380 DATA 14 14 14 14 14 14
     14 14 14 14 14 14 14 15 15 1
     5 227
C3   1390 DATA 15 15 15 15 15 17
     17 17 17 17 17 17 17 39 39 3
     9 328
8F   1400 DATA 39 25 25 25 25 28
     28 28 28 25 25 25 25 25 25 2
     5,426
75   1410 DATA 25 25 25 25 25 10
     10 10 10 10 10 10,10 5 5,5 2
     32
18   1420 DATA 5 47 47 47 47,42 4
     2 42 42 59 59 59 59 59 59
     778
F6   1430 DATA 59 53 53 53 53 53
     53 53 53 47 47 47,47 47 47 4
     7 812
CF   1440 DATA 47 15 15 15 15 14
     14 14 14 11 11 11 11 11 11 1
     1 240
0C   1450 DATA 11 11 11 11 11 12
     12 12 12 12 12 12 12 14 14 1
     4 193
8C   1460 DATA 14 14 14 14 14 14
     14 14 14 14 14 14 14 15 15 1
     5 227
03   1470 DATA 15 15 15 15 15 17
     17 17 17 17 17 17 17 39 39 3
     9 328
0F   1480 DATA 39 25 25 25 25 28
     28 28 28 25 25 25 25 25 25 2
     5 426
B5   1490 DATA 25 25 25 25 25 28
     28 23 23 25 23 23 23 28,28,2
     8,428
F3   1500 DATA 28 28 28 28 28 26
     26,21,21 26 26 26,26 25,25,2
     5 413
0C   1510 DATA 25 25 25 25,25,23
     23 18 18 23 23 23 23 25,25,2
     5 374
01   1520 DATA 25 25 25 25 25 14
     14 14,14,5 5 5 5 5 5 5 216
00   1530 DATA 5 5 5 5 5 0 0 0 0 0
     0 0 0 0 0,0 0 25
4E   1540 DATA 31 31 31 31 31 210
     210 210 210 210 210 210 210
     ,195 195 195 2420
67   1550 DATA 195 195 195 195 19
     5 195 195 195 195 195 195 19
     5 195,195 195 195 3120
04   1560 DATA 195 195 195 195 19
     5,210 210 210 210 210 210 21
     0 210 195 195,195 3240
78   1570 DATA 195 195,195 195 19
     5 195 195 195,195 195 195,19
     5 195 195 195 195 3120
A7   1580 DATA 195 195 195 195 19
     5 143 143 143 143 143 143 14
     3 143 24 24 24,2191
C6   1590 DATA 24 24 24 24 24 239
     239 239 239 239 239 239 239
     210 210 210 2662
02   1600 DATA 210 210 210 210 21
     0 195 195 195 195 195 195 19
     5 195 223 223 223 3279
25   1610 DATA 223 30 30 30 30 49
     49 49 49 30 30 30 30 30 30
     30 749
E3   1620 DATA 30 30 30 30 30 143
     ,143,143,143 143,143,143,143
     247 247 247,2035
E8   1630 DATA 247 107 107 107 10
     7 62 62 62 62 190 190 190 19
     0 190 190 190 2253
31   1640 DATA 190 57 57,57 57 57
     57 57 57 107 107,107 107 10
     7 107 107 1395
A0   1650 DATA 107 210 210,210 21
     0 239 239 239 239 218 218 21
     8 218 218 218 218 3429
35   1660 DATA 218 218 218 218 21
     8 143 143 143 143 143 143 14
     3 143 24 24 24 2306
56   1670 DATA 24 24 24 24 24 239
     ,239 239 239 239 239 239 239
     210 210 210 2662
52   1680 DATA 210 210 210 210 21
     0 195 195 195 195 195 195 19
     5,195 223 223 223 3279
33   1690 DATA 223,30 30 30 30 49
     ,49 49 49 30 30 30 30 30 30
     30 749
59   1700 DATA 30 30 30 30 30 223
     223 181 181 223 223 223 223
     49 49 49 1537
17   1710 DATA 49 49 49 49 49 156
     156 31 31 156 156 156 156 3
     0 30 30 1333
3    1720 DATA 30 30 30 30 30 181
     181 209 209 181 181 181 181
     30 30 30 1744
78   1730 DATA 30 30 30 30 30 24
     24 24 24 71 71 71 71 71 71 7
     1 743
EC   1740 DATA 71 71 71 71 71 0 0
     0 0 0 0 0 0 0 0 0 0 355
38   1750 DATA 0 0 0 0 0 17 17 17
     16 0 0 0 0 17 17 17,118
E5   1760 DATA 16 0 0,0 0 17,17 1
     7 16 0 0 0 0 17 17 17,134
EF   1770 DATA 16 0 0 0 0,17 17 1
     7 16 0 0 0 0 17 17 17 134
65   1780 DATA 16 0 0 0 0 17 17 1
     7 16 0 0 0 0 17 17 17 134
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8E  1790 DATA 16 0 0 0,0 17 17 1
    7 16 0 0 0 0 17 17 17 134
32  1800 DATA 16 0 0 0 0 17 17 1
    7 16 0 0 0 0 17 17 17 134
60  1810 DATA 16 0 0 0 0 17 17 1
    7 16 0 0 0 0 17 17 17 134
26  1820 DATA 16 17 17 17 16 17
    17 17 16 17 17 17,16,0 0,0 2
    17
45  1830 DATA 0 0 0 0,0 17 17 17
     16 0 0 0 0 17 17 17 118
12  1840 DATA 16 17 17 17 16 17
    17 17 16 17 16 17 16 17 17 1
    7 267
6B  1850 DATA 16 17 16 17 16 17
    17 17 16 17 16 17 16 17 17 1
    7 266
2E  1860 DATA 16 17 17 17 16 17
    17 17 16 17 17 17 16 0 0 0 2
    17
71  1870 DATA 0 0 0 0 0 17 17 17
     16 0 0 0 0 17 17 17 118
42  1880 DATA 16 0 0 0 0 17 17 1
    7 16 0 0 0 0 17 17 17 134
30  1890 DATA 16 0 0 0 0 17 17 1
    7 16 0 0 0 0 17,17 17 134
76  1900 DATA 16 17 17 17 16 17
    17 17 16 17 17 17 16 0 0,0 2
    17
8C  1910 DATA 0 0 0 0 0 17 16 17
     16 17 17 17 16 17 17 17 184
7E  1920 DATA 16 0 0 0 0 17 16 1
    7 16 17 [illegible] 16 17 17 17 20
    0
18  1930 DATA 16 0 0 0 0 17 16 1
    7 16 17 17 17 16 17 17 17 20
    0
56  1940 DATA 16 0 0 0 0 17 17 1
    7 16,17 17 17 17 17 17 17,20
    2
5B  1950 DATA 16 0 0 0 0 0 0 0 0 0
    ,0 0 0 0 0 0 0 16
3C  1960 DATA 0 0 0 0 0 0 0 0 0 0
    0 0 0 0 0 0 0 0 0
7C  1970 DATA 173 255 204 240 6
    208 255 204 76 166 204 169 4
     141 255 204 2084
EC  1980 DATA 165 15 141 24 212
    169 5 141 5 212 165 57 141 6
     212 169 1851
AE  1990 DATA 10 141 12 212 169
    58 141 13 212 165 5 141 19 2
    12 169 9 1694
43  2000 DATA 141 20 212 169 7 1
    41 10 212 165 128 141 5 212
    173 60 133 2017
F4  2010 DATA 141 0 212 173 0 19
    2 141 1 212 173 160 154 141,
    4 212 173 2125
56  2020 DATA 80 197 141 7 212 1
    73 0 186 141 8 212 173 160 1
    98 141 11 2050
57  2030 DATA 212 173 80 201 141
     14 212 173 0 200 141 15 212
     173 160 202 2309
4A  2040 DATA 141 16 212 173 63
    204 201 154 208 21 173 62 20
    4 201 152 208 2435
BE  2050 DATA 14,162 48 165 205
    204 157 82 204 202 16 247 76
     182 204 182 2335
61  2060 DATA 0 32 156 204,162 6
    ,32 156 204 162 12 32 156 20
    4 162 18 1818
56  2070 DATA 32 156 204 162 24
    32 156 204 162 30 32 156 204
     162 36 32 1504
AC  2080 DATA 156 204 162 42 32
    156 204 162 48 32 156 204 16
    5 1 141 25 2014
3B  2090 DATA 208 76 49 234 254
    62 204,208 3 254 63 204 56 8
    0 153 141 2325
CF  2100 DATA 0 212,173 0 192 14
    1 1 212 173 160 154 141,4 21
    2 173 80 2068
4E  2110 DATA 197 141 7 212 173
    0 186 141 8 212 173 160 198
    141 11,212 2182
F5  2120 DATA 173 80,201 141 14
    212 173 0 200 141,15 212 173
     160 202 0 2097
CA  2130 DATA 120 169 31 141 13
    220 141 13 221 173,13 220,17
    3 13 221 169 2051
CF  2140 DATA 0 141 20 3 169 204
    ,141 21 3 169 1 141 26 208 8
    8 96 1431
```

JOYSTICK CURSOR

PROGRAM JOYCURS SRC

THIS PROGRAM ONLY TO BE ENTERED
IF YOU ARE USING AN ASSEMBLER

```
10 OPEN1,8 1,"JOYCURS OBJ" SYS32768
20  OPT P,01  SYM 2
30 ,
100 ,
110  "
120 ,"|JOYSTICK CURSOR V2.3|
130 ,"|                    |
140  "|   J  KEW, JAN 88   |
150 ,'|                    |
160 '|   SOURCE CODE FOR   |
170 ,  |ASSEMBLER/MONITOR 64|
180 ,'
190 ;
200 *-$033C
210 INT - $0314
220 JV - $DC00
230 XMAX - $0289
240 BUFFL - $C6
250 KBUF = $0277
260 ,PLUS TBITZ  END OF PROG
290 ,
300 INIT  SEI              ,TOGGLE
310       LDA #<TBITZ      ROUTINE
320       EOR INT          ON/OFF
330       STA INT
340       LDA #>TBITZ
350       EOR INT+1
360       STA INT+1
370       CLI
380       RTS
390
400 START LDA JV
410       AND #$1F      ISOLATE J/S BITS
420       TAY
430       LDA TAB Y    ,LOAD CHARACTER
440       BEQ OUT1     ,FINISH IF NULL
450       CMP LASTC    ,COMPARE WITH LAST
460       BNE RESDL    ,IF DIFF, BRANCH
461       LDX RFLG     ,REPEAT FLAG
462       BNE DECDL    ,REPEAT ON
463       BEQ OUT
470 RESDL LDX #10       RESET DELAY
480       STX REPDL
490       BNE CHARP    ,JUMP
500 DECDL LDX REPDL
510       BEQ DECCT    ,IF DELAY-0
520       DEX          ,DECREMENT
530       STX REPDL
540       BEQ RESCT    ,IF DELAY NOW-0
550       BNE OUT      ,IF NOT, FINISH
560 DECCT DEC REPCT    ,DEC COUNTER
570       BNE OUT      ;IF NOT-0  FINISH
580 RESCT LDX #4       ,IF -0  RESET
590       STX REPCT
600 CHARP LDX BUFFL    ,PROCESS CHAR
610       CPX XMAX
620       BEQ OUT      ,IF FULL  FINISH
630       STA KBUF,X   ,STORE CHAR
640       INX          ,INC LENGTH
```

```
650          STX BUFFL
660 OUT1   STA LASTC
670 OUT    JMP $EA31    EXIT
690
700 LASTC  BYT $00
710 REPCT  BYT $04
720 REPDL  BYT $0A
730 RFLG   BYT $01
790 ,
800             -    -    -    -    -  FSE
810 TAB   BYT $00_$00 $0J $'. $ 0 $00
820
830            FNE FE   -  FSW FNW FW
840       BYT $00,$94 $00 $0C $00 $14
```

```
850
860             -  FS  FN  F    -    -
870        BYT $00 $20 $0D,$00 $00,$00
890
900             -    -    -  SE  NE   E
900        BYT $00 $00,$00,$1D $1D $1D
910
920             -  SW  NW   W    -   S
930        BYT $00 $9D $9D,$9D,$00 $11
940
950             N    -
960        BYT $91 $00
970
1000 TBITZ - START ↑ $EA31
```

PROGRAM JOYCURS

```
6D  10 A-A+I IFA-1THENLOAD JOYCU
    RS OBJ  8 1
28  20 SYS828
EB  30 POKE53280 0 POKE53281 0 P
    RINT [CLR DOWN WHITE]  CHR$(
    14) TAB(13)  [SJ]OYSTICK[SC]
    URSOR
B1  40 PRINTTAB(13) [CT14]
53  50 PRINT [DOWN]  TAB(12)  [C
    8 SJ]  [SN]EW[SPCD SJ]AN  88

0D  60 PRINT [DOWN3 RIGHT9 SU]SE
     A JOYSTICK IN PORT 2
13  70 PRINT [DOWN RIGHT2 SS SY
    SS] 828[SPC4]  TOGGLES ROUTI
    NE ON/OFF
DD  80 PRINT [RIGHT2 SP SO SK SE
    ] 922 1   REPEAT JOYKEYS
63  90 PRINT [RIGHT2 SP SO SK SE
    ] 922 0   REPEAT OFF
0E  100 PRINT [DOWN RIGHT2 SU]SE
     PROGRAM [SJ SO SY SM SO SD]
     TO MODIFY ROUTINE
E9  110 PRINT [DOWN2 RIGHT5 SJ]O
    YSTICK CURSORING IS NOW [SO
    SN]
C*  120 PRINT [DOWN3 C5 SPC1] SP
    ]RESS A KEY TO EXIT [WHITE]

IF  130 GETA$ IFA$-  THEN130
C6  140 PRINT [CLR]
```

PROGRAM JOYMOD

```
6D  10 A-A+1 IFA-1THENLOAD JOYCU
    RS OBJ  8 1
5C  20 POKE53281 0 POKE53280 0 P
    RINTCHR$(142) [WHITE]  GOSUB
    400 PRINT [DOWN4]MODIFY [Y/N
    ] ?
B2  30 GETA$:IFA$-  THEN30
B5  40 IFA$- N THEN160
FL  50 IFA$<> Y THEN30
.A  60 FORN-1TO17 READDR$ DD$ P
    COSUB400
E3  70 PRINT [HOME DOWN4]  TAB(3
    0   N[RIGHT DOWN2]E[DOWN2 LE
    FT3]S[LEFT3 UP2]W[RIGHT]  DD
    $
15  80 PRINT [HOME DOWN10[PRESS
    YE: FOR DIRECTION OR - FOR R
    (LL  PRINT [DOWN]  DR$
8C  90 GETA$ IFA$-  THEN90
```

```
7"  100 POKE323+P AS (A$) NEXTN
.4  11   GOSUB400 PRINT [DOWN4]RE
    PEAT FLAG ON [Y/N] ?
14  1 0  GETA$ IFA$-  THEN120
42  130 RF-0 IFA$- Y THENRF-1 GO
    TO16
DA  140 IFA$<> N THEN120
.E  150 POKE922 RF
61  160 GOSUB400
22  170 PRINT ]DOWN4]SAVE (Y/N)
    ?
E2  180 GETA$ IFA$-  THEN180
32  190 IFA$- N THEN230
61  200 IFA$<> Y THEN180
"2  210 PRINT INPUT FILENAME   F
    $
54  220 SYS57812F$ 8 1 POKE193 6
    0 POKE194 3 POKE174 108 POKE
    175 3 SYS62957
EE  230 PRINT [CLR]  END
6B  30  DATA NORTH   [SW UP LEFT
     S ]  30  NORTHEAST  [SW UP
    SN]  2.  EAST   [SW S*]  23

C1  310 DATA SOUTHEAST   [SW DOW
    N SM]  21  SOUTH   [SW DOWN
    LEFT S ]  29  SOUTHWEST  [S
    W DOWN LEFT2 SN]  25
15  320 DATA WEST   [SW LEFT2 S*
    ]  27  NORTHWEST   [SW UP LE
    FT2 SM]  26  FIRE    [SQ]  15

A0  330 DATA FIRE+NORTH   [SQ UP
     LEFT S ]  14  FIRE+NORTHEAS
    T   [SQ UP SN]  6  FIRE+EAST
      [SQ S*]  7
6B  340 DATA FIRE+SOUTHEAST   [S
    Q DOWN SM]  5  FIRE+SOUTH
    [SQ DOWN LEFT S ]  13
C1  350 DATA FIRE+SOUTHWEST   [S
    Q DOWN LEFT2 SN]  9  FIRE+WE
    ST   [SQ LEFT2 S*]  11
15  360 DATA FIRE+NORTHWEST   [S
    Q UP LEFT2 SM]  10
CB  400 PRINT [CLR DOWN]  TAB(9)
     MODIFY JOYSTICK CURSOR
9B  410 PRINTTAB(9) [CY22]
2B  420 RETURN
```

PROGRAM JOYCURS LOADER

```
86  10 BL-7 LN-50 SA-828
5B  20 FOR L-0 TO BL CX-0 FOR D-
    0 TO 15 READ A CX-CX+A POKE
    SA+L*16+D A:NEXT D
A5  30 READ A IF A><CX THENPRINT
     ERROR IN LINE   LN+(L*10) ST
    OP
86  40 NEXT L
62  50 DATA 120 169 126 77 20 3
```

```
    141 20 3 169 233 77 21 3 141
    21 1344
E8  60 DATA 3 88 96 173 0 220 41
    31 168 185 155 3 240 55 205
    151 1814
A3  70 DATA 3 208 7 174 154 3 20
    8 9 240 46 162 10 142 153 3
    208 1730
DE  80 DATA 23 174 153 3 240 8 2
    02 142 153 3 240 7 208 26 20
    6 152 1940
A0  90 DATA 3 208 21 162 4 142 1
    52 3 166 195 236 137 2 240 9
    157 1840
B8  100 DATA 113 2 242 134 198 1
    41 151 3 76 49 234 0 4 10 1
    0 1354
30  110 DATA 0 0 1 0 0 0 148 0 0
     0 20 0 32 13 3 0 213
4E  120 DATA 0 0 0 0 29 29 29 0
    157 157 157 0 17 145 0 0 720

88  130 PRINT  [CLR]THE DATA FOR
     JOYCURSOR IS NOW IN THE
91  140 PRINT  CASSETTE BUFFER

46  150 PRINT  IF YOU ARE A DISK
     USER THEN YOU CAN SAVE
C0  160 PRINT  THE PROGRAM AS MA
    CHINE CODE BY TYPING
34  170 PRINT  POKE 43 60 POKE44
     3 POKE45 188 POKE46 3
3D  180 PRINT  CLR SAVE +CHR$(34
    )+ JOYCURS OBJ +CHR$(34)+  8

29  190 PRINT IF YOU ARE USING C
    ASSETTE THEN YOU WILL
FE  200 PRINT HAVE TO ADD THIS P
    ROGRAM TO ANY
0C  210 PRINT PROGRAM THAT YOU W
    ISH TO USE JOYCURSOR
55  220 PRINT WITH  [R/SON]NOTE[
    R/SOFF] ANY CASSETTE LOAD OR
     SAVE
BA  230 PRINT WILL ERASE THE JOY
    CURSOR PROGRAM
B1  240 PRINT    IF YOU KNOW HOW
    TO USE AN ASSEMBLER
E4  250 PRINT  YOU COULD RELOCAT
    E THE MACHINE CODE TO
B7  260 PRINT  ANOTHER ADDRESS B
    Y ENTERING THE
5F  270 PRINT ASSEMBLER RATHER T
    HAN THE BASIC LOADER
20  280 PRINT  IF YOU DO NOT SAV
    E JOYCURS OBJ THEN YOU
58  290 PRINT MUST DELETE THE LO
    AD INSTRUCTIONS FROM
B2  300 PRINT THE OTHER PROGRAMS
     FOR THIS ARTICLE AND
D2  310 PRINT MAKE SURE THAT YOU
     HAVE RUN THIS PROG
E0  320 PRINT BEFORE RUNNING THE
    M
```

HI-RES FILL

PROGRAM HI-RES FILL

```
47  10 P=491
69  20 READ> IF<- 1THENEND
4D  30 PO>EP ,
EF  40 FOR -1TO7 READY POKEP+C ,
     Y=(+Y NEXTC
77  50 READM IFM<>XTHENPRINT ERR
    OR IN LINE PEEK(63)+PEEK(64
    *256 END
95  60 P P+8 GOTO20
D7  1000 DATA 169 57 141 24 208
    173 2 221 995
BF  1010 DATA 9 3 141 2 221 169
    148 141 834
FD  1020 DATA 0 221 169 204 141
    136 2 173 1046
FF  1030 DATA 17 208 9 32,141 17
     208 96 728
E5  1040 DATA 169 21 141 24 208
    173 2 221 959
A7  1050 DATA 9 3 141 2 221 169
    151 141 837
61  1060 DATA 0 221 169 4 141 13
    6 2 173 846
9D  1070 DATA 17 208 41 223 141
    17 208 96 951
31  1080 DATA 169 0 162 224 133
    251 134 252 1325
AF  1090 DATA 160 0 145 251 200
    208 251 230 1445
70  1100 DATA 252 208 247 96 165
     20 24 41 1053
84  1110 DATA 248 121 112 192 13
    3 78 165 21 1070
1B  1120 DATA 121 137 192 133 79
     165 156 41 1024
77  1130 DATA 7 168 165 20 41 7
    170 96 674
68  1140 DATA 0 64 128 192 0 64
    128 192 768
76  1150 DATA 0 64 128 192 0 64
    128 192 768
54  1160 DATA 0 64 128 192 0 64
    128 192 768
2C  1170 DATA 0 224 225 226 227
    229 230 231 1592
97  1180 DATA 232 234 235 236 23
    7 239 240 241 1894
CE  1190 DATA 242 244 245 246 24
    7 249 250 251 1974
A6  1200 DATA 252 254 128 64 32
    16 8 4 758
98  1210 DATA 2 1 32 84 192 32 1
    9 193 555
E3  1220 DATA 189 162 192 17 78
    145 78 32 893
C2  1230 DATA 36 193 96 32 84 19
    2 32 19 684
07  1240 DATA 193 189 162 192 73
    255 49 78 1191
BE  1250 DATA 145 78 32 36 193 9
    6 32 84 696
C0  1260 DATA 192 32 19 193 189
    162 192 81 1060
F3  1270 DATA 78 145 78 32 36 19
    3 96 32 690
88  1280 DATA 84 192 32 19 193 1
    89 162 192 1063
8A  1290 DATA 49 78 32 36 193 20
    1 0 96 685
78  1300 DATA 56 163 199 225 155
     144 21 133 1106
1A  1310 DATA 155 74 74 74 168 1
    65 21 74 805
DF  1320 DATA 208 10 165 20 144
    9 40 18 614
C8  1330 DATA 193 [illegible] 1 46 32 32
     1[illegible] 76 830
[illegible]  1340 DATA 72 178 1[illegible] [illegible] 173
    31 [illegible] 41 262
DE  1350 DATA 254 141 14 2[illegible] 165
     1 4 [illegible] 1 89
[illegible]  1360 DATA 1[illegible]3 1 1 4 96 [illegible]
    [illegible] 5[illegible]1
[illegible]  1370 DATA [illegible] 133 1 1[illegible]3 14 220
    [illegible] 1 [illegible]
[illegible]  1380 DATA 14[illegible] 14 2 [illegible] 1[illegible]4 9[illegible]
    [illegible] 174 1734
[illegible]  1390 DATA [illegible] 23[illegible] 133 144 55
    [illegible]
[illegible]  1400 DATA [illegible] 193 32
    1 [illegible] 114[illegible]
[illegible]  1410 DATA [illegible] 1 [illegible] 240 1
    [illegible] 18[illegible] [illegible]1
[illegible]  1420 DATA 1 [illegible] 193 [illegible]
    [illegible] 1[illegible] 1[illegible]
[illegible]  1430 DATA [illegible] 1[illegible] [illegible] 0 [illegible]
    3 [illegible]
ED  1440 DATA [illegible] 1[illegible] 1[illegible] [illegible] 1
    [illegible] 41 [illegible] 1
3F  1450 DATA [illegible] 1[illegible] 4[illegible] 0 193
    1[illegible] 15[illegible] 141 [illegible]62
E2  1460 DATA [illegible] 1[illegible] 1[illegible] [illegible] 1
    93 174 [illegible] 1[illegible]
88  1470 DATA 1[illegible] 1[illegible] [illegible] 134 21
    17[illegible] 48 1[illegible] [illegible]
D3  1480 DATA 1[illegible] 1[illegible] [illegible] 2 [illegible]
    20[illegible] 2 23[illegible] 10[illegible]4
F8  1490 DATA [illegible] 9[illegible] [illegible]
     198 21 741
1C  1500 DATA 138 [illegible] 1[illegible]
    208 2 230 1[illegible]39
61  1510 DATA 1[illegible] 46 1[illegible] 1[illegible]5 [illegible]
    2 198 156 113[illegible]
9D  1520 DATA 193 1[illegible] [illegible] 2 [illegible]
    193 160 0 1[illegible]4[illegible]
50  1530 DATA 177 251 1 [illegible] 2[illegible]
     177 251 133 1[illegible]42
9E  1540 DATA 21 [illegible] 1 [illegible] 1[illegible]
     155 200 14[illegible] 1[illegible]
C7  1550 DATA 2[illegible] 1 [illegible] 143 96
    32 215 193 1[illegible]45
74  1560 DATA 160 0 165 20 145 2
    51 230 165 1106
85  1570 DATA 21 145 251 200 165
     155 145 251 1333
88  1580 DATA 200 173 92 193 145
    251 96 169 1319
6C  1590 DATA 0 162 200 133 251
    134 252 174 1306
7F  1600 DATA 93 193 202 240 16
    24 165 251 1184
A8  1610 DATA 105 4 133 251 165
    252 105 0 1015
26  1620 DATA 133 252 76 226 193
     96 173 94 1243
A9  1630 DATA 193 16 43 32 99 19
    3 173 92 841
AC  1640 DATA 193 48 6 32 147 19
    3 76 12 707
4C  1650 DATA 194 32 154 193 168
     185 201 255 1349
A1  1660 DATA 240 66 201 200 240
     62 32 240 1281
40  1670 DATA 192 32 223 192 240
     54 169 0 1102
5E  1680 DATA 141 94 193 76 84 1
    94 32 99 913
A0  1690 DATA 193 173 92 193 48
    6 32 147 884
E8  1700 DATA 193 76 55 194 32 1
    54 193 165 1062
AF  1710 DATA 165 201 255 240 23
     201 200 240 1525
33  1720 DATA 19 32 243 192 32 2
    23 192 208 11[illegible]8
03  1730 DATA 1[illegible] 169 1[illegible]8 14[illegible] 94
    193 239 93 1067
32  1740 DATA 193 32 189 193 32
    115 133 173 1120
81  1750 DATA 95 19[illegible] 1[illegible] 4[illegible] [illegible]
    193 173 844
32  1760 DATA 92 193 1[illegible] [illegible] 3 1[illegible]
    193 78 755
E9  1770 DATA 165 194 [illegible] 154 [illegible]
    165 195 201 120[illegible]
AE  1780 DATA [illegible]
    240 78 32 13[illegible]
A1  1790 DATA 24[illegible] 192 [illegible] 19[illegible]
    240 76 169 [illegible]
E9  1800 DATA 0 111 [illegible] 93 [illegible] 1[illegible]
    7 194 32 9[illegible]
74  1810 DATA 99 193 173 9 1[illegible]
    16 6 32 804
41  1820 DATA 147 1[illegible] [illegible] 1[illegible] 1[illegible]
    32 154 193 1141
49  1830 DATA 1[illegible] 155 [illegible] 253 [illegible]
    0 39 201 [illegible] 1[illegible]
CD  1840 DATA 240 35 32 240 192
    32 223 192 1186
D0  1850 DATA 208 27 169 128 141
     95 193 238 1199
8F  1860 DATA 93 193 173 92 193
    73 128 141 1086
61  1870 DATA 92 1[illegible] 32 189 193
    173 92 193 11[illegible]
32  1880 DATA 73 128 141 94 193
    32 115 193 969
8E  1890 DATA 9[illegible] 32 [illegible] 193 32 70
    8 194 98 934
FE  1900 DATA 169 1 141 93 193 1
    41 92 193 1023
FC  1910 DATA 169 1 141 94 193 1
    41 35 194 10[illegible]
80  1920 DATA 32 40 192 3[illegible] [illegible]
    192 208 13 113[illegible]
E7  1930 DATA [illegible] 138 193 1[illegible]
    37 41 201 [illegible]
1B  1940 DATA [illegible]55 [illegible] 208 [illegible]
    32 131 193 129[illegible]
A2  1950 DATA 32 240 193 32 [illegible]
    192 208 14 11[illegible]8
47  1960 DATA 32 173 192 [illegible]
    193 32 131 1051
32  1970 DATA [illegible] 165 2 201 64
    208 233 169 1[illegible]
E6  1980 DATA 21 240 [illegible] 1[illegible]
    193 240 19 1208
01  1990 DATA 32 169 [illegible]
    193 32 243 1152
97  2000 DATA 1[illegible] 32 [illegible] 1[illegible] 240
    6 173 93 11[illegible]
83  2010 DATA 193 208 [illegible]
    216 194 167 [illegible]
C8  2020 DATA [illegible] 16[illegible] 234 134 78
    32 [illegible] 160 947
98  2030 DATA [illegible] 145 [illegible]
    21 230 79 1191
3C  2040 DATA 166 [illegible] 234 [illegible]
     243 96 32 1256
C3  2050 DATA 253 174 [illegible] 5[illegible] 1[illegible]
     138 32 47 1017
AD  2060 DATA 195 96 3[illegible] 5 [illegible]
    2 223 192 1018
75  2070 DATA 96 0 0 0 [illegible] 0 [illegible]
    5
E9  2080 DATA 1
```

PROGRAM HI-RES DEMO

```
46  1 POKE53280 6+8
7B  2 DEFFNR1(X)=INT(RND(1)*264)+5
CE  3 DEFFNR2(Y)=INT(RND(1)*144)+5
83  10 SYS49152 REM HIRES
49  11 PRINT (CLR)
8A  30 SYS49991 5 REM SET COLOUR
54  50 SYS49218 REM CLEAR GRAPHIC
41  60 FORD=0TO19
2C  70 O1=FNR1(0) O2=FNR2(0) GOSUB
     1000 SYS49184 REM LORES
16  80 NEXTD
```

```
C4  100 SYS49865 5,199-5 REM FILL
CJ  110 POKE53280 5
DC  120 POKE198 0 WAIT198
 | POKE198 D
6A  999 END
10  1000 FORC=0TO50
41  1010 SYS49470 O1 O2+C REM
PLOT
83  1020 SYS49470 O1+C O2 REM
PLOT
21  1030 SYS49470 O1+C O2+50 REM
PLOT
51  1040 SYS49470 O1+50 O2+C REM
PLOT
DF  1050 NEXTC
A6  1060 RETURN
```

CODE RELOCATION

```
PROGRAM  RELOC BL
```

```
10 GOTO50000
20089 DATA 10 8 10 0 158 50 48 5
4
20097 DATA 45 0 0 0 32 68 229 16
2
20105 DATA 0 142 133 9 32 173 8
174
20113 DATA 133 8 189 195 8 240 6
 32
20121 DATA 210 255 232-208 245 2
32 189 195
20129 DATA 8 208 230 32 207 255
201 13
20137 DATA 208 249 160 0 185 2 5
 201
20145 DATA 48 176 8 201 7 176 39
 105
20153 DATA 9 208 7 56 233 48 201
 10
20161 DATA 176 28 192 1 240 10 1
0 10
20169 DATA 10 10 141 133 9 200 2
08 220
20177 DATA 13,133 9 141 129 9 16
9 0
20185 DATA 141 128 9 76 109 8-23
8 32
20193 DATA 208 76 19 8 234 169 1
36 133
20201 DATA 73 169 5 133 74 173 1
30 9
20209 DATA 133 75 173 131 9 133
76 160
20217 DATA 0 162 0 177 73 205 13
2 9
20225 DATA 208 14 161 75 24 109
129 9
20233 DATA 145 73 230 75 208 2 2
30 76
20241 DATA 200 208 2 230 74 204
130 9
20249 DATA 208 225 165 74 205 13
1 9 208
20257 DATA 218 76 248,8-162 0-18
9 187
20265 DATA 8 240 6 32 210 255 23
2 208
20273 DATA 245 96 13 13 29 29 29
 29
20281 DATA 29 0 42-80 82 79 71 8
2
20289 DATA 65 77 32,82 69 76 79
67
20297 DATA 65 84 79 82 42 · 76 6
9
20305 DATA 78 71 84 72 61 · 7E
48
20313 DATA 53 56 51 0 R6 69 76 7
3
20321 DATA 67 65 84 69 32 84 79
58
20329 DATA 36 67 48 48 48 0 0 16
8
20337 DATA 0 133-73-173 129 9 13
3.74
20345 DATA 169 136 133 75 169 9
133 76
20353 DATA 160 0 177 75 145 73 2
30 73
20361 DATA 208 2 230 74 230 75 2
08-2
20369 DATA 230 76 165 75 205 130
 9 208
20377 DATA 233 165 76 205 131 9
208 228
20385 DATA 32 173 8-162 0 189 95
 9
20393 DATA 240 6 32 210 255 232
208 245
20401 DATA 32 228 255 240 251 20
1 89 240
20409 DATA 28 32 173 8 162 0,189
 111
20417 DATA 9 240 6 32 210 255 23
2 208
20425 DATA 245 174 128 9 173 129
 9 32
20433 DATA 205 189 96 108 128 9
82 85
20441 DATA 78 32 78 79 87 63 32
40
20449 DATA 89 47 78 41 32 0 83 8
9
20457 DATA 83 32 65 68 68 82 69
83
20465 DATA 83 32 73 83 58 32 0 0
20473 DATA 0 11 15 19 0 0,0 76
20481 DATA 74 19 169 0 141 65 19
 173
20489 DATA 57 19 133 73 173 58 1
9 133
20497 DATA 74 160 0 177 73 205-6
5 19
20505 DATA 240 23 230 73 208 2 2
30 74
20513 DATA 165 73 205 59 19 208
235 165
20521 DATA 74 205 60 19 208 229
76 56
20529 DATA 19 238 65 19 208 208
24 96
20537 DATA 0 192 16 192 16 192 0
 96
20545 DATA 0 173-57 19 133 73 13
3 75
20553 DATA 173 58 19 133 74 173
64 19
20561 DATA 133 76 160 0 177 73,2
09 75
20569 DATA 240 3 32 129 19 200 2
08 4
20577 DATA 230 74 230 76 165 74
205 60
20585 DATA 19,208 233 204 59 19
208 228
20593 DATA 173-180 19 24 109 59
19 141
20601 DATA 61 19 165 78 141 62 1
9 96
20609 DATA 173-179 19 208-13-238
 179 19
20617 DATA 173 59 19 133 77 173
60 19
20625 DATA 133 78 177 73 72 173
65,19
20633 DATA 145 73 140 181 19 104
,56 237
20641 DATA 56,19 172 180 19 145
77 172
20649 DATA 181 19 238 180 19 208
 2 230
20657 DATA 78 96 0 0 6 162 0 189
20665 DATA 41 19 240 6 32 210 25
5 232
20673 DATA 208 247 96 169 147 32
 210 255
20681 DATA 162 0 142 181 19 32 1
82 15
20689 DATA 174 181 15 189 49 19
240 6
20697 DATA 32 210 255 232 208 24
5 232 189
20705 DATA 49,19 208 230 96 169
0 141
20713 DATA 39 19 162 6 142 40 19
 160
20721 DATA 25 24 32 240 255 32 2
07 255
20729 DATA 240,251 174 39 19 238
 39 19
20737 DATA 157 237 19 201 13-208
 238 174
20745 DATA 40 19 232,232 224 12
144 220
20753 DATA 96 32 166 19 32 230 1
9 162
20761 DATA 88 32 203 19 32 228 2
55 240
20769 DATA 251 201 78 240 236 96
 0-0
20777 DATA 13 13 29 29 29 29 29
0
20785 DATA 29 29 29 29 29 29 18
69
20793 DATA 76 78 32 73 78 80 85
84
20801 DATA 32 73 78 32 72 69 88
146
20809 DATA 17 17 0 83 84 65 82 8
4
20817 DATA 32 79 70 32 65 83 83
69
20825 DATA 77 66 76 89 49-58-0 8
3
20833 DATA 84 65 82 84 32 79 70
32
20841 DATA 65 83 83 69 77 66 76
89
20849 DATA 50 58 0-69,78 68 43 4
8
20857 DATA 32 79 70 32 65 83 83
69
20865 DATA 77 66 76 89 49 58 0 0
20873 DATA 65 82 69 32 89 79,85.
32
20881 DATA 83 85 82 69 32 80 47
78
20889 DATA 0 0 76 79 79 75-73 78
20897 DATA 71 32 70 79 82 32-77
65
20905 DATA 82 75 69 82 0 0 77 65
20913 DATA 82 75 69 82 32 70 79
85
20921 DATA 78 68 32,45-32-80 82
69
20929 DATA 80 65 82 73 78 71 32
80
20937 DATA 82 79 71 82 65 77 0 0
20945 DATA 77 65 82-75-69-82 32
78
20953 DATA 79 84 32 70 79 85 78
68
20961 DATA 32 45 32 69 88 73 84
73
20969 DATA 78 71-0 0 65 55 67 68
20977 DATA 13 88 70,65 66 13 49
50
20985 DATA 51 52 13 160 0,189 23
7 19
20993 DATA 232 201 13 240 246 20
1 64 176
21001 DATA 8 56 233 48 76 18 15
233
```

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21009 DATA 95 142 1 74 6 141 66
19
21017 DATA 2 [illegible] 106 [illegible] 14 68 19
14 66
21025 DATA 19 14 64 14 11 66 19
13
21033 DATA 66 14 96 162 [illegible] 160 0
140
21041 DATA 67 19 32 2[illegible] 19 172 6
7 19
21049 DATA 1[illegible] 68 14 [illegible]00 172 6 [illegible]
08 239
21057 DATA 96 0 0 0 [illegible] 1 [illegible]
21065 DATA 0 [illegible] [illegible] 1[illegible] 19 32 44
19
21073 DATA 32 162 19 3[illegible] 69 2 [illegible] 1
62 105
21081 DATA 32 203 15 [illegible] [illegible] 19 176
[illegible]6
21089 DATA 162 160 3 21[illegible] 19 3[illegible]
162 128
21097 DATA 32 20[illegible] 19 3[illegible] 6[illegible] 1[illegible] 3[illegible]
220
21105 DATA 19 32 158 19 42 54 19
96
21113 DATA 173 68 19 141 5[illegible] 19
73 68
21121 DATA 19 141 56 19 173 71 1
9 141
21129 DATA 63 19 173 70 19 141 [illegible]
4 19
21137 DATA 173 73 19 141 59 19 [illegible]
73 72
21145 DATA 19 141 60 19 96 173 [illegible]
7 19
21153 DATA 160 0 56 233 135 133
73 141
21161 DATA 248 19 173 58 19 [illegible] 1
1 133
21169 DATA 74 141 249 19 169 250
133 75
21177 DATA 169 19 133 76 177 75
145 73
21185 DATA 230 73 208 2 230 74 2
30 75
21193 DATA 208 2 230 76 16[illegible] 74 2
05 58
21201 DATA 19 208 243 16[illegible] [illegible] 205
57 19
21209 DATA 208 2 6 96 174 59 19
56 237
21217 DATA 57 19 141 57 19 173 6
0 19
21225 DATA 237 58 19 141 58 19 1
69 136
21233 DATA 24 109 57 19 141 123
19 189
21241 DATA 9 109 58 19 141 124 1
9 162
21249 DATA 0 173 58 19 41 140 74
74
21257 DATA 74 74 24 105 48 201 5
8 144
21265 DATA 3 24 105 7 157 217 19
232
21273 DATA 124 4 24 21 121 3 20
8 8
21281 DATA 173 58 19 41 15 76 11
19
21289 DATA 173 57 19 204 2 240 [illegible]
13 208
21297 DATA 24[illegible] 173 65 19 141 12[illegible]
19 96
21305 DATA 0 0 162 0 189 199 19
240
21313 DATA 6 3[illegible] 210 [illegible] 232 208
245 162
21321 DATA 0 32 20[illegible] [illegible]85 24[illegible] 251
201 13
21329 DATA 240 8 1[illegible]7 18[illegible] 19 232
224 13
21337 DATA 208 2[illegible]9 224 [illegible] 240 [illegible] 6
142 197
21345 DATA 19 164 0 18[illegible] [illegible]01 19 2
40 [illegible]
21353 DATA 7[illegible] 210 [illegible] [illegible] 2[illegible] [illegible]
9 32 207
21361 DATA 25[illegible] [illegible]40 [illegible]1 [illegible] 13 [illegible]4
0 5 141
21369 DATA 14 14 18 24 17 14
8 19 56
21377 DATA 233 40 201 1 [illegible] [illegible]
1 8
21385 DATA 2[illegible] 176 1 [illegible] [illegible] 1[illegible]
0 3
21393 DATA 1[illegible] 255 173 14 19 [illegible]
2 192 160
21401 DATA 19 32 189 255 [illegible] 140
13 133
21409 DATA 73 173 249 19 17[illegible] 7[illegible]
169 73
21417 DATA 174 61 19 1[illegible] [illegible] 1[illegible]
32 208
21425 DATA 1 200 [illegible] 21[illegible] 255 [illegible] 3
[illegible] 32
21433 DATA 32 32 32 32 3[illegible] [illegible] 3[illegible]
32
21441 DATA 32 32 42 32 [illegible] 13 [illegible]
21449 DATA 17 17 17 29 29 8 6[illegible]
79
21457 DATA 71 82 65 77 32 78 [illegible]
77
21465 DATA 69 58 32 0 13 17 1 [illegible]
9
21473 DATA 29 79 85 84 80 85 64
32
21481 DATA 68 6[illegible] 86 73 [illegible]7 69 3[illegible]
4[illegible]
21489 DATA 49 47 56 41 58 32 0 0
21497 DATA 0 10 [illegible] 10 0 158 53 48
21505 DATA 54 49 0 0 0 32 68 229
21513 DATA 162 0 142 133 9 32 17
3 9
21521 DATA 174 133 9 18[illegible] 185 8 2
40 6
21529 DATA 32 210 255 232 208 24
5 23[illegible] 189
21537 DATA 195 8 208 230 32 2[illegible]7
255 201
21545 DATA 13 208 249 160 0 185
2 5
21553 DATA 201 48 178 8 201 7 17
6 39
21561 DATA 105 9 208 [illegible] 56 [illegible]33 48
201
21569 DATA 10 176 28 192 1 240 1
0 10
21577 DATA 10 10 10 141 133 5 20
0 208
21585 DATA 220 13 133 9 141 129
[illegible] 169
21593 DATA 0 141 128 9 76 109 8
238
21601 DATA 32 208 76 13 8 234 16
[illegible] 136
21609 DATA 133 73 169 [illegible] 13[illegible] 74 1
73 130
21617 DATA 9 133 75 173 131 9 13
3 76
21625 DATA 160 0 162 0 177 7[illegible] 20
5 142
21633 DATA 9 208 24 161 [illegible] 24 10
9 129
21641 DATA 9 145 73 230 75 208 2
230
21649 DATA 76 [illegible]00 208 2 230 74 2
04 130
21657 DATA 9 20[illegible] 225 165 74 205
141 9
21665 DATA 208 [illegible]18 76 248 8 162
0 189
21673 DATA 187 8 240 6 32 210 25
[illegible] 232
21681 DATA 208 245 96 13 13 [illegible]9 2
9 29
21689 DATA 29 39 0 42 80 82 79 7
1
21697 DATA 82 65 77 32 82 69 76
79
21705 DATA 67 65 84 79 82 42 0 7
[illegible]
21713 DATA 69 79 71 84 [illegible]2 61 3
[illegible]
21721 DATA 49 5[illegible] 48 48 0 82 [illegible]
[illegible]
21729 DATA [illegible]9 [illegible] [illegible] 84 69 32 84
79
21737 DATA [illegible]8 36 6[illegible] 4[illegible] 48 48
21745 DATA 6[illegible] 133 73 1[illegible]4 1[illegible]
[illegible] 133
21753 DATA 74 16[illegible] 136 133 7[illegible] 1[illegible]
[illegible] 133
21761 DATA 76 16[illegible] 1[illegible] 75 1[illegible]
3 [illegible]
21769 DATA 73 [illegible]6 2 23 74 [illegible]
[illegible] 208
21777 DATA 2 [illegible]30 76 [illegible] [illegible]
30 9
21785 DATA 206 [illegible]33 16[illegible] 76 2[illegible] [illegible]
[illegible] 9 208
21793 DATA 226 32 1[illegible] 8 1[illegible]
9 9[illegible]
21801 DATA 9 240 6 32 [illegible]1[illegible] 1[illegible]
2 208
21809 DATA 245 32 [illegible]2[illegible] [illegible] [illegible]4
1 201 89
21817 DATA 240 26 32 173 [illegible] 1[illegible]
188
21825 DATA 111 9 240 6 32 [illegible]
5 232
21833 DATA 208 245 174 1[illegible] [illegible]
129 9
21841 DATA 32 205 189 96 1 [illegible]
9 82
21849 DATA 85 78 32 78 [illegible]9 [illegible] [illegible]
32
21857 DATA 40 69 47 78 4[illegible] 3[illegible]
3
21865 DATA 89 83 32 65 68 6[illegible]
65
21873 DATA 83 83 32 73 89 52 [illegible]
0
21881 DATA 0 0 0 0 0 0 0 0
21889 DATA 247 247 [illegible] 0 0 [illegible] 0
21897 DATA 0 0 0 0 0 0 3 [illegible]
21905 DATA 0 0 0 0 0 0 0 0
21913 DATA 0 0 0 0 0 [illegible] 0 [illegible]
21921 DATA 0 0 0 1 1 1 1 1
21929 DATA 2 1 1 0 0 [illegible] 1 2
21937 DATA 2 2 2 2 2 2 2 [illegible]
21945 DATA 2 2 1 2 2 0 0 0
21953 DATA 0 0 2 2 [illegible] 2 0 2
21961 DATA 0 2 3 2 0 2 0 [illegible]
21969 DATA 0 0 3 0 3 3 0 [illegible]
21977 DATA 0 0 3 0 0 3 [illegible] [illegible]
21985 DATA 3 5 3 4 3 3 3 0
21993 DATA 5 3 3 3 [illegible] [illegible] 3 [illegible]
22001 DATA 3 3 3 0 [illegible] 0 256
50000 M=2049 PRINT {CLR}{DOWN}{D
OWN}{RGHT}{RGHT}{RGHT}{RVS}LOCAT
ION {OFF}
50010 FORL=0TO1 L=0
50020 READV IFV=256THENL=1 GOTO5
0050
50030 POKEM V PRINT {HOME}{DOW
N}{DOWN}{RGHT}{RGHT}{RGHT}{RGHT}{R
GHT}{RGHT}{RGHT}{RGHT}{RGHT}{RGH
T}{RGHT}{RGHT}  M
50040 M=M+1
50050 NEXT
50060 INPUT {CLR}{DOWN}{DOWN}{DO
WN}{RGHT}{RGHT}FILENAME  F$
50070 INPUT {DOWN}{DOWN}{RGHT}{R
GHT}TAPE{T}/DISC{D} ;O$
50080 IFF$=  ORO$<> T ANDO$<>
THEN50060
50085 O=1*ABS(O$= T )+8*ABS(O$=
D )
50090 PRINT {CLR}{DOWN}{DOWN}SAV
E CHR$(34) F$ CHR$(34) ; O
50094 H=INT(M/256) L=M-H*256 POK
E252 L POKE253 H
50095 POKE46 PEEK(253) POKE45 PE
EK(252)
50100 POKE631 13 POKE198 1 PRINT
```

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EUROPEAN II	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A
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901226-01	[illegible]
901225-01	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
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C64 MOD	[illegible]
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Our address is on the classified pages

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At the *Your Commodore* office we receive hundreds of letters from readers every month We do try and answer each individually but sometimes this is impossible due to pressure of work If you have written to us and not received a personal reply we apologise for this but we cannot promise to reply to every item of mail we receive If you feel that your question or letter really needs an answer then inclusion of an s a e will guarantee a reply, although this may still take time to arrive

Bug Finder

We'd like to remind our readers that we run a Bug Finder service

If you have typed in one of our programs and despite much checking you still can t get it to run then send us the following

Two copies of your program on tape or disk
A description of your problem
If possible a listing of your work (you may omit this)
A stamped self addressed envelope for return of the program to you

Should any of the above be missing then we will not be able to deal with your query

We will try to point out where you have made errors and place a corrected copy of the program back on to your tape or disk before we return it to you

Do not send a program to us as soon as it stops working please check it several times first

We do get a large number of queries and so it may take a while for us to deal with yours personally

Note we can only deal with problems relating to programs published in *Your Commodore*

Commodore Where Are You?

At the *Your Commodore* office we are repeatedly asked for the address and telephone number of Commodore U K Many people after referring to their computer manuals believe them to be based in Corby

The Commodore plant at Corby was closed down some time ago Reproduced here you will find the correct address for Commodore U K

We suggest that you write this correct address in the front of your computers manual for future reference

Commodore Business Machine (UK)
Commodore House
The Switchback
Gardner Road
Maidenhead
Berks SL6 7XA

Competition Winners

At last the eagerly awaited result of the **Micronet** competition which we ran in the May issue And the winner of the highly acclaimed ProPak which comprises the Telemap modem and software is Bruce Belton of Henfield, Sussex Congratulations Bruce!

We have a Scottish winner for the June **Board Game** competition Brian Graham of Ayr wins The Colossus Series which comprises Chess Bridge and Maj Jong The ten runners up will each receive a Maj Jong set read on and see if it's you,

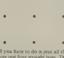
David Fairweather, Blackburn, A Betesta Derby M R Evres, Co Galway, P Moisejeus, Swindon, K Patel, Crawley, Allan Parker, Huntingdon G Patel, Surrey, Dixie Dean, Littlehampton, J Hicks Redditch Dave Parish, West Wickham

The three lucky winners of the **Graphics** competition which we ran in the July issue are Michael Suchoruczka, Nottingham M Moore, Ipswich, J Davey, Torquay They will all receive a graphics package comprising Photo Finish, BillBoard Maker, Icon Factory Screen F X and Clipart from Financial Systems Software The seven runners up will each receive a copy of the popular F X package They are R H Underwood Surbiton, Eugene Morgan, C Down, A Haddon, Nottingham, G G Brown, Tyne & Wear, M J New, Canterbury, Sean Whelan, Plumstead, G Snowling, Sudbury

Puzzle Corner

PUZZLE CORNER

Another simple one this month Imagine that there are nine dots arranged in a 3 x 3 grid (see diagram)



All you have to do is join all the dots using just four straight lines The only snag is that each new line must start where the old one finishes

Send entries to, *Grid Puzzle* Your Commodore, A S P Ltd, 1 Golden Square, London W1R 3AB

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You won't find these programs in the top ten!

These programs have sold thousands of copies and yet you won t have seen them in the charts — why?

We produce programs that you can really get your teeth into Programs like **BUSICALC** and **BUSICALC 3** which can be used at home or in the office to do all sorts of calculations, forecasts and budgets

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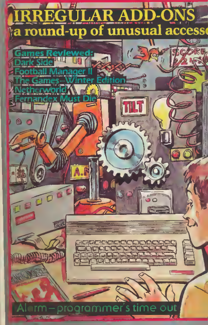
a round-up of unusual access



Games Reviewed:
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Alarm – programmer's time out

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